DATA BASE MANAGEMENT SOFTWARE

INPUT

ABOUT INPUT

INPUT provides planning information, analysis, and recommendations to companies in the information processing industries. Through market research, technology forecasting, and competitive analysis, INPUT supports client management in making informed decisions. Continuing services are provided to users and vendors of computers, communications, and office products and services.

The company carries out continuous and in-depth research. Working closely with clients on important issues, INPUT's staff analyze and interpret the research data, then develop recommendations and innovative ideas to meet clients' needs. Clients receive reports, presentations, access to data on which analyses are based, and continuous consulting.

Professional staff have, on average, nearly 20 years experience in the information processing industry. Most have held senior management positions in operations, marketing, or planning. This expertise enables INPUT to supply practical solutions to complex business problems.

Formed in 1974, INPUT has become a leading international consulting firm. Clients include over 100 of the world's largest and most technically advanced companies.

OFFICES

UNITED STATES

2180 Sand Hill Road
Menlo Park, CA 940
(415) 854-3422

Park 80 Plaza West-
Saddle Brook, NJ 07
(201) 368-9471

pany, Ltd.
Kita-Aoyama

EUROPE

INPUT Europe
500 Chesham House
150 Regent Street
London, W1R 5FA
England
London 439-6288
Telex 261426

PGP Sistema SRL
20127 Milano
Via Soperga 36
Italy
Milan 284-2850

va Street
7. 2072

DATA BASE MANAGEMENT SYSTEMS SOFTWARE MARKETS

IMPACT REPORT #8

MAY 1978

DATA BASE MANAGEMENT SYSTEMS SOFTWARE MARKETS

TABLE OF CONTENTS

		Page
I	INTRODUCTION	1
II	EXECUTIVE SUMMARY	2
	A. Scope And Key Conclusions	2
	1. DBMS Characteristics	2
	2. Market Forecast	3
	3. User Characteristics	3
	4. Vendor Characteristics	5
	B. Impact of Technology	6
	C. Market Structure	7
	1. Number Of DBMS Installations By 1983	7
	2. A Growing Share For Mainframe Vendors	7
	D. Technical Recommendations	9
	E. Marketing Recommendations	10
III	MARKET ANALYSIS AND FORECAST	11
	A. Industry Structure	11
	1. Definitions	11
	2. Types Of DBMS	14
	3. Types Of Vendor	16
	B. Market Forecast	18
	1. Market Structure	18
	2. Large DBMS Market Considerations	18
	3. Medium-Sized DBMS Market Considerations	21
	4. Small DBMS Market Considerations	22
	5. Very Small DBMS Market Considerations	23
	6. Detailed DBMS Market Forecasts By Size Categories	23
	7. Market Share By Vendor Type	34

		Page
	C. Impact Of Changing Technology	37
	1. Distributed Data Base Trends	37
	2. Data Base Computers ("Back-End" DBMS Processors)	38
	3. Storage, Communications, And Other Developments	44
IV	ANALYSIS OF USERS	46
	A. General Characteristics Of Firms Surveyed	46
	1. Firms Without DBMS Installed	46
	2. Firms With DBMS Installed	46
	B. The DBMS Selection Process	49
	1. DBMS Product Evaluation	49
	2. DBMS Selection Criteria	50
	3. Decision Makers In The Selection Process	52
	4. Use Of DBMS On Remote Computing Services (RCS)	52
	5. An Example Of A Detailed User Analysis	53
	C. Why A Specific DBMS Product Was Selected	56
	1. IMS	56
	2. IDMS	57
	3. TOTAL	57
	4. ADABAS	58
	5. SYSTEM 2000	59
	6. Minicomputer Based DBMS	59
	D. DBMS User Expenditures	59
	E. DBMS Impact On Hardware Upgrades	61
	F. Programmer Skill Level Required	62
	G. Growth in DBMS Use	62
	H. DBMS Use By Application	65
	I. DBMS Use By Industry Sector	70
	J. DBMS Use By Mainframe Type	70
V	COMPETITIVE ENVIRONMENT	77
	A. Market Structure And Interview Profile	77
	B. Vendor Revenue From DBMS Products	78
	1. Market Size	78
	2. Market Share By Vendor	80
	C. Vendor's Estimate Of Product Growth, 1978-1983	84
	D. DBMS Product Enhancements By Vendors	86
	E. DBMS Hardware Capability	88
	F. User Selection Criteria As Viewed By Vendors	88
	G. Price Comparison Of DBMS Products	90
	1. Base Prices And Total Price	90
	2. Purchase, Lease, Maintenance Comparisons	92
	H. The Issue Of Standardization	92
	I. Two Recent Developments In DBMS	93
	J. Key Vendor Profiles	95
	1. Cincom	95
	2. Computer Corporation Of America	95

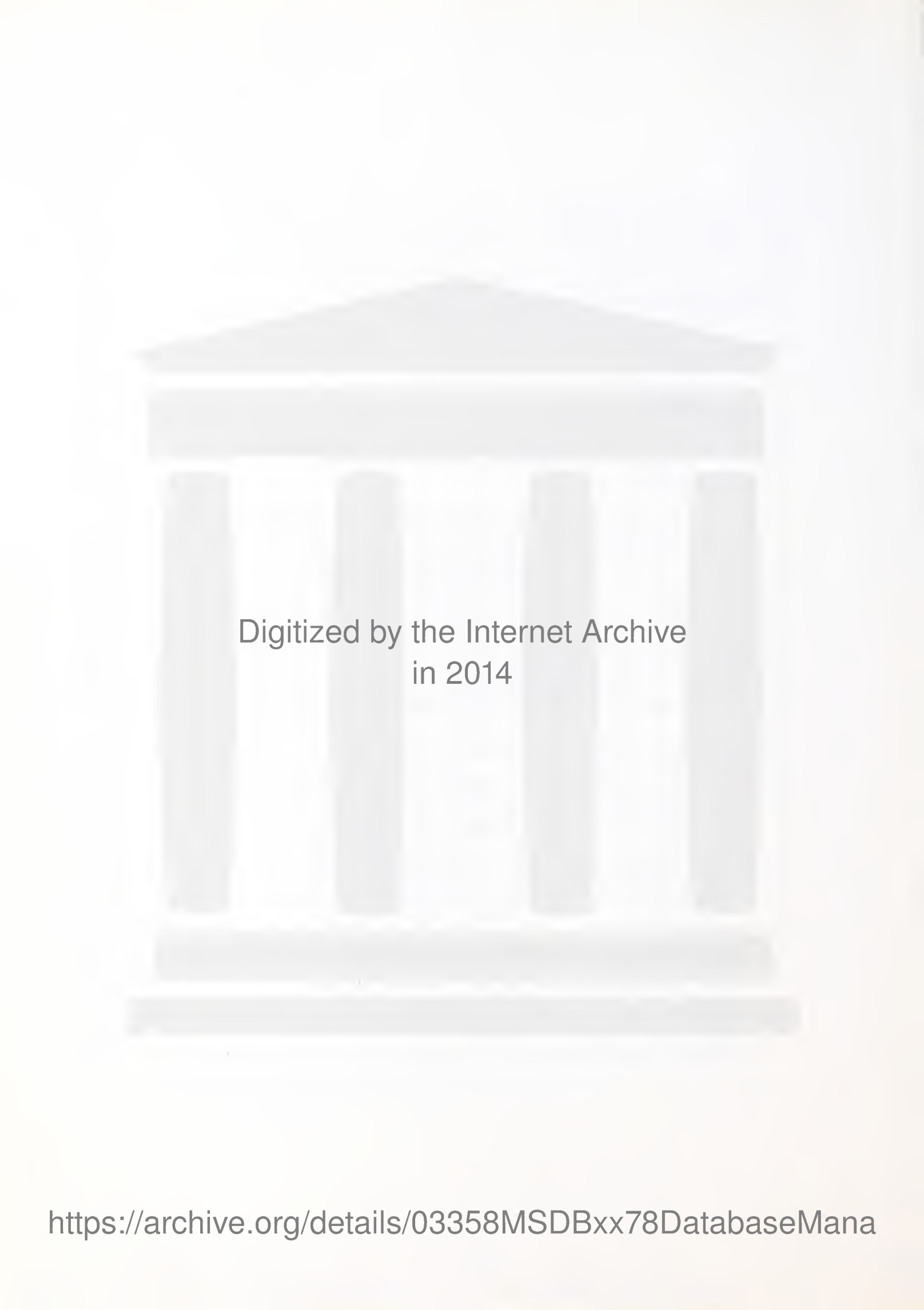
		Page
	3. Control Data Corporation	96
	4. Cullinane	96
	5. Digital Equipment Corporation	97
	6. Hewlett-Packard	98
	7. Honeywell	99
	8. Infodata	100
	9. Insyte Datacom Corporation	101
	10. International Data Base Systems, Inc.	102
	11. MRI Systems Corporation	103
	12. Software AG	104
	13. Software House	104
	K. Recent DBMS Announcements Of RCS Vendors	105
	1. Automatic Data Processing	105
	2. National CSS	106
	3. Computer Sciences Corporation	106
VI	PRODUCT AND MARKETING ISSUES	110
	A. Impact Of Technology On DBMS	110
	B. Product Strategies For Technology Issues	111
	1. Minicomputer Use Of DBMS	111
	2. Off-Loading The Host Computer Through Use Of Minis	111
	3. Emergence Of Text/Graphics Data Bases	113
	C. Product Strategies For DBMS	114
	1. Desired Attributes Of Current DBMS Offerings	114
	2. Desired Improvements In Current DBMS Offerings	116
	D. Marketing Strategies For DBMS	118
	1. Competing With IBM	118
	2. Educating DP Managers	121
	3. Marketing In A Distributed Data Processing (DDP) Environment	121
	4. Industries Best Suited For DBMS And DDP	127
	5. Marketing To An Expanding User Base	127
APPENDIX A:	INTERVIEW PROFILE FOR THE DATA BASE MANAGEMENT SOFTWARE MARKETS	133
APPENDIX B:	DEFINITIONS	134
APPENDIX C:	RELATED INPUT REPORTS	139
APPENDIX D:	SURVEY QUESTIONNAIRES	140

DATA BASE MANAGEMENT SYSTEMS SOFTWARE MARKETS

LIST OF EXHIBITS

			Page
II	-1	DBMS Lease/Purchase/Maintenance Expenditures Growth, 1977-1983	4
	-2	Installations Of DBMS And Penetration Of Computer Base, 1977 And 1983	8
III	-1	Relationship Of DBMS Software To Other Systems Software	12
	-2	Market Share By Size Of DBMS, 1977 And 1983	19
	-3	Characteristics Of DBMS By Size Category	20
	-4	DBMS Market Forecast By Size Of DBMS	24
	-5	Lease/Purchase/Maintenance Expenditures For All DBMS, 1977 And 1983	25
	-6	Large DBMS: Forecasted Installations, Shipments, And Markets, 1977 Through 1983	27
	-7	Medium-Sized DBMS: Forecasted Installations, Shipments, And Markets, 1977 Through 1983	28
	-8	Small DBMS: Forecasted Installations, Shipments, And Markets, 1977 Through 1983	29
	-9	Very Small DBMS: Forecasted Installations, Shipments, And Markets, 1977 Through 1983	30
	-10	Lease/Purchase/Maintenance Expenditures For Large DBMS, 1977 And 1983	31
	-11	Lease/Purchase/Maintenance Expenditures For Medium-Sized DBMS, 1977 And 1983	32
	-12	Purchase/Maintenance Expenditures For Small DBMS, 1977 And 1983	33
	-13	Software Companies' And Computer Manufacturers' Share Of The DBMS Market, 1977 And 1983	36
	-14	DBMS Organization In A Distributed And Back-End Processing Environment	40

			Page
IV	-1	Distribution Of Installed DBMS Products And Average Length Of Installation	48
	-2	DBMS Considered But Not Selected By Respondents	51
	-3	An EDP Manager's Evaluation Of DBMS Products	54
	-4	Programmer Skill Level Required For DBMS As Perceived By Respondents	63
	-5	DBMS Use As A Percentage Of Total Applications	64
	-6	Anticipated Growth In DBMS Usage Among Current DBMS Users	68
	-7	Ten Applications Most Frequently Mentioned By Respondents	69
	-8	DBMS Use By Industry Sector	71
	-9	DBMS Use By Mainframe According To Respondents	72
	-10	User Satisfaction By DBMS Type According To Respondents	75
V	-1	Identified Vendor Revenues From DBMS And Number Of Packages Installed	79
	-2	Vendors' Share Of The Identified DBMS Market	81
	-3	Comparison Of Total DBMS Package Sales With 1977 Sales	83
	-4	Composite Vendor DBMS Sales Forecast For Medium And Large Scale Systems	85
	-5	DBMS Hardware Comparisons	89
	-6	Pricing Of DBMS Products	91
	-7	Comparison Of ADP And NCSS Hardware Offerings	107
VI	-1	User Ranking Of Attributes Of Current DBMS Offerings	115
	-2	User Ranking Of Desired Improvements In Current DBMS Offerings	117
	-3	Respondents' Perception Of Other DP Managers' Knowledge	122
	-4	Responses Regarding Implementing Applications Using DBMS And DDP	124
	-5	User Responses To Statements Concerning DBMS And DDP	126
	-6	Users Designation Of Industries Best Suited For DBMS And DDP	128
	-7	Data Base Management System Services Market Share By Product Strategy, 1976-1981	130
	-8	Data Base Management Systems Services Product Strategy Implications	132



1 INTRODUCTION

I INTRODUCTION

- This report is produced by INPUT as part of the Market Analysis Service and analyzes the market for Data Base Management Systems (DBMS).

- This area of research was selected because of high client interest. Data base management software is one of the fastest growing areas in the software products market.

- The purpose of this study is to analyze and make recommendations about the present and future market for DBMS, rather than to provide technical product descriptions which are readily available from numerous sources.

- Before the research began, INPUT clients were asked to suggest particular questions and specific areas of interest to be incorporated in the study. A number of points were added to the questionnaire as a result of client comments.

- Research concluded for this report included a series of interviews as specified in Appendix A. Separate interview questionnaires were used for vendors, users and a general mail questionnaire. Copies of the questionnaires are included in Appendix D.

- Interviews were conducted during February and March 1978.

- Definitions of terms used in this report are presented in Appendix B.

- Inquiries and comments on the information presented in this report are invited from clients.

II EXECUTIVE SUMMARY

II EXECUTIVE SUMMARY

A. SCOPE AND KEY CONCLUSIONS

1. DBMS CHARACTERISTICS

- Data Base Management Systems (DBMS) have emerged as a major market opportunity for independent vendors of software, remote computing services, and computer hardware. DBMS are an important issue at a user level where these systems are increasingly being used in applications development.

- DBMS are software packages that manage structured data. A DBMS "protects" the application program from physical storage activities. Products such as IDMS, IMS, TOTAL, ADABAS, and System 2000 are characterized as DBMS.

- Data managed by a DBMS can also be accessed through implementation languages or query language software. Products such as RAMIS, MARK IV, and EASYTRIEVE are so characterized.

  - Although these products are related to DBMS, they are not included in the forecasts in this report, nor are the proprietary DBMS products of remote computing services vendors. However, these related products are mentioned where appropriate.

- DBMS are incorporating implementation language features and vice versa. Thus, in the 1980s it will be increasingly difficult to distinguish between the two types of products.

2. MARKET FORECAST

- The DBMS market will expand from $86 million in 1977 to almost $900 million in 1983, at an average annual growth rate of 48%.

- As shown in Exhibit II-1, use of DBMS is spreading down from the large systems such as IBM System/370 Model 168s to smaller computers. Growth in minicomputer DBMS is already under way and the first microcomputer DBMS is now being delivered.

  - Leasing of DBMS will grow at 40% per year, slower than the overall market, because of the expansion in product purchases, particularly at smaller size levels.

  - Expenditures for outright purchase of DBMS will grow at 54% per year.

  - Expenditures for maintenance of purchased products will grow faster (68% per year) than those for actual purchase, as costs of people, travel, etc., increase. Even the use of labor reduction methods such as network diagnostics will not avoid increases in maintenance charges.

3. USER CHARACTERISTICS

- Current users anticipate increased use in applications using DBMS going from a current level of approximately 10% to a 1981 level of 30% of installed applications.

- Users want systems that are easy to use as a means to accelerate applications development.

  - In large sites, price is relatively unimportant.

EXHIBIT II-1

DBMS LEASE/PURCHASE/MAINTENANCE EXPENDITURES GROWTH 1977 TO 1983

SIZE OF DBMS	1977 ($ MILLIONS)				1983 ($ MILLIONS)				AVERAGE ANNUAL GROWTH RATE (%)
	LEASE	PURCHASE	MAINTE-NANCE	TOTAL	LEASE	PURCHASE	MAINTE-NANCE	TOTAL	
LARGE	$36	$15	$3	$54	$200	$165	$ 65	$430	41%
MEDIUM	14	10	4	28	135	80	30	250	44
SMALL	–	3	1	4	–	100	85	185	90
VERY SMALL	–	0	–	0	–	25	–	25	∞
TOTAL	$50	$28	$8	$86	$335	$370	$180	$890	48%

- Users are not well informed or particularly interested in the issue of data models. They are more concerned on end results rather than how the systems are structured.

- Non-technical users are growing in importance, particularly in the markets represented by medium and small mainframes.

- IMS from IBM is generally considered by users to be too complex and cumbersome compared to products from independent software vendors.

- Competition is keen at the user level, with users carrying out extensive evaluations prior to selecting a DBMS.

- Increasingly, users implement more than one DBMS.

4. VENDOR CHARACTERISTICS

- Hardware vendors will more aggressively market DBMS as they recognize its importance in revenue potential and account control.

- IBM, the largest DBMS vendor, will introduce new products in the forecast period with hardware/firmware/software features.

- Independent software vendors are confident they can continue to grow at an average 35% per year based on current products and enhancements.

  - Some are moving in new directions which include hardware product offerings and application packages based on DBMS software.

- Remote computing services vendors who offer services based on DBMS are considering expanded marketing of DBMS software.

  - Two major RCS vendors, NCSS and ADP, recently announced contributions of DBMS software and hardware.

B. IMPACT OF TECHNOLOGY

- Backend processors, the implementation of all or part of a DBMS in hardware, will have some negative impact on software sales.
  - INPUT does not anticipate that IBM will implement this approach. It is more likely to integrate a DBMS processor in future mass storage devices.
  - Other technology companies will implement this approach and will attain revenues of approximately $200 million by 1983.
- Less expensive communications, particularly from Satellite and Value Added Network (VAN) vendors, will allow distribution and transmission of large data bases.
  - This will accelerate the implementation of Distributed Data Processing (DDP) incorporating DBMS.
    - DDP is still little understood at the user level.
    - The major impact will be post-1980.
- Systems and applications dictionaries will become the main control tools for data:
  - These dictionaries will implement privacy and security features.
  - They are keys to future development for DBMS.
- Data will increasingly merge with text and graphics and "Information Based Management Systems" (IBMS) will emerge in the early 1980s.

C. MARKET STRUCTURE

1. NUMBER OF DBMS INSTALLATIONS BY 1983

- The number of DBMS installed in 1983 will be 30 times the current level. Yet saturation levels will still not be attained in many areas, as shown in Exhibit II-2.
  - The number of large systems installed is expected to increase 400%.
  - Medium-scale systems will increase 300% in the next five years.
  - These two size categories drive the market growth for current DBMS. Small and very small systems drive the emerging market for mini DBMS.

2. A GROWING SHARE FOR MAINFRAME VENDORS

- Computer manufacturers will grow their share of the DBMS market by 58% per year on average and will have two-thirds of the market ($580 million) by 1983:
  - They see this as a very critical user control point.
  - Success of independent vendors in the past has exploited deficiencies in the computer manufacturers' DBMS lines, notably IBM's IMS.
- Independent software companies will grow their market share at about 35% per year over the present period and will develop a $300 million market share.

EXHIBIT II-2

INSTALLATIONS OF DBMS AND PENETRATION OF COMPUTER BASE, 1977 AND 1983

SIZE OF DBMS	1977		1983	
	NO. OF DBMS INSTALLATIONS	PENETRATION OF COMPUTERS AT THIS SIZE LEVEL	NO. OF DBMS INSTALLATIONS	PENETRATION OF COMPUTERS AT THIS SIZE LEVEL
LARGE	1,600	67%	7,000	90%
MEDIUM	2,700	45%	13,000	80%
SMALL	2,000	<1%	60,000	6%
VERY SMALL	–	0	90,000	8%*
TOTAL	6,300		170,000	

*OF MICRO BASED COMPUTER SYSTEMS

D. TECHNICAL RECOMMENDATIONS

- New DBMS products should be developed rather than relying solely on enhancements to existing products:
  - Many current products were conceived in the 1960s.
  - Current vendors can capitalize on what was learned during implementation of existing products in the design and development of new products.
- New products should emphasize ease of use, have communications capability, and be targeted at one of the market sizes identified in this study, e.g., large, medium, small, or very small.
- Vendors should leverage their DBMS capability by developing application specialized DBMS for specific applications and industries such as Software AG's development of ADABOMP for manufacturing.
- Vendors should capitalize on networks for remote diagnostics, troubleshooting, and updating:
  - Also, for support functions such as education and technical assistance.
  - Use of networks will be particularly advantageous in reaching small users in DDP environments.
- Software vendors considering offering back-end processors:
  - Must recognize that a special configuration must be built, instead of adapting a standard mini.
  - Should approach a leading technology company such as Intel, Fairchild, or Texas Instruments.

E. MARKETING RECOMMENDATIONS

- Vendors should charge on a per-CPU basis with limited discounting on multiple CPUs and/or multiple sites:
  - Price is seldom a determining factor in user selection.
  - Site pricing will limit the revenue growth of DBMS in the emerging DDP environment.
- In anticipation of increasing maintenance costs, vendors should target to increase annual maintenance charges from the current average level of 8% of purchase cost to 12% over the forecast period.
- Features such as query languages and data dictionaries should be priced separately as a means of building revenue per user.
- As industry specialized marketing grows, salesmen must be trained to understand user problems as compared to curent "features" selling.
- To approach the small and medium users, software vendors should consider joint ventures with mini and micro computer companies:
  - To minimize marketing costs .
  - Accelerate market penetration.
- Independent software vendors should continue to target the large CPU market which will grow to 8,000 units by 1983:
  - Each of which has the potential to be a $100,000 software sale.

III MARKET ANALYSIS AND FORECAST

III MARKET ANALYSIS AND FORECAST

A. INDUSTRY STRUCTURE

1. DEFINITIONS

- Data base management systems (DBMS) and implementation languages are closely related:

  - A data base management system is a software system whose primary function is to manage structured data.

  - An implementation language is a software system whose primary function is to develop applications programs. It may have DBMS functions; it is likely to interface with more than one DBMS.

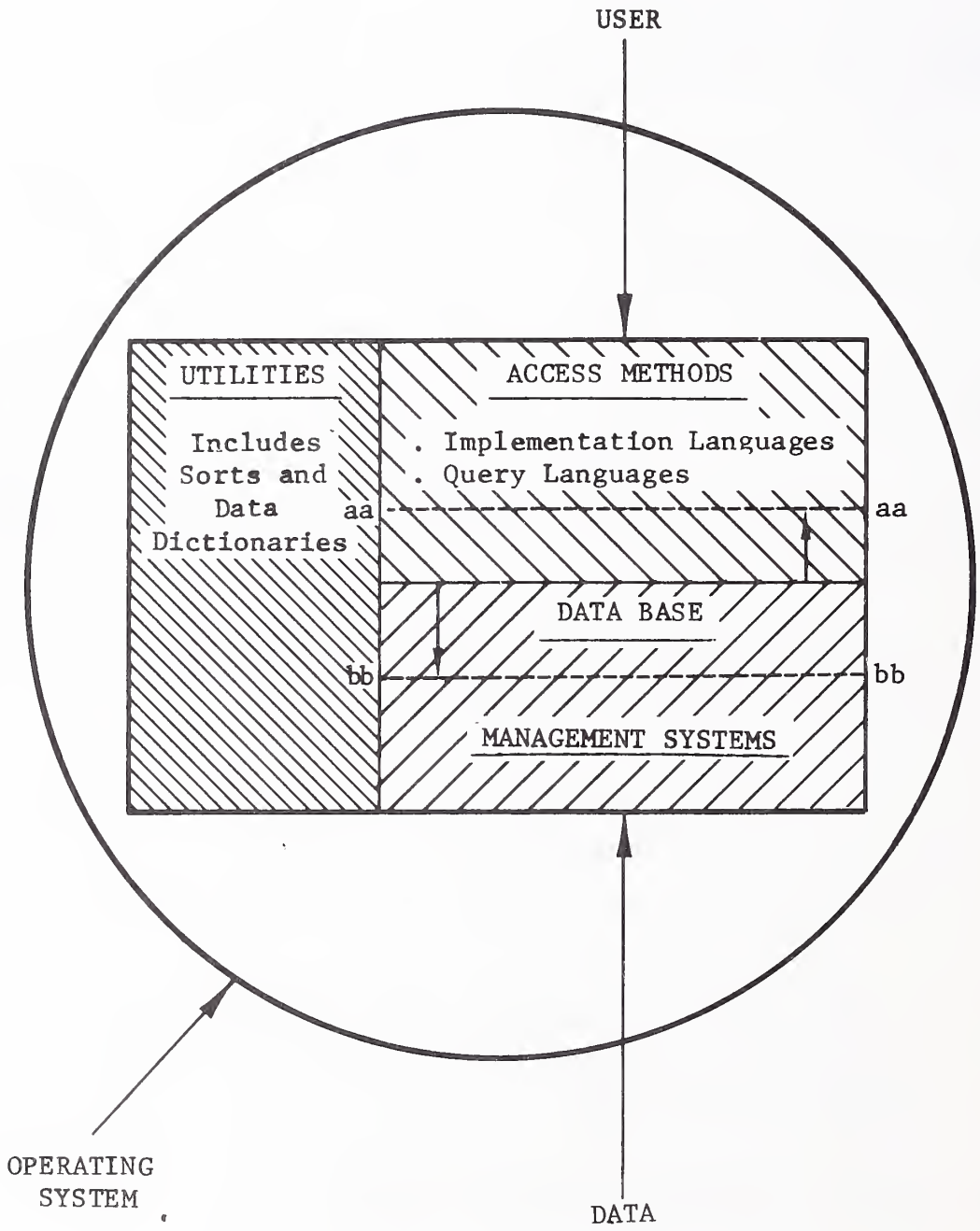
  - A query language is a software system whose primary function is to access and process data on an ad hoc basis and present it to the user in a format of his definition.

- This report only addresses the market for DBMS.

- As illustrated in Exhibit III-1, a user accesses the data through an implementation language, which may be COBOL, RAMIS, MARK IV, or similar systems.

EXHIBIT III-1

RELATIONSHIP OF DBMS SOFTWARE TO OTHER SYSTEMS SOFTWARE



- Characteristics of a DBMS are:
  - Data managed are accessible by more than one user at the same time.
  - Users are "protected" from physical storage activities.
  - Data is defined and retrieved at the element level.
  - Provides access methods for updating, inserting, deleting, and retrieving data.
  - High degree of program independence.
  - Security and recovery capabilities.
- In addition, a DBMS may provide:
  - Data dictionary.
  - Report generation capability.
  - Query language.
- The number of characteristics and features supported by a DBMS varies widely, as does the degree to which these functions are implemented.
- As shown in Exhibit III-1 by the line "aa," DBMS are increasingly including access methods, while implementation languages, in some cases, are including DBMS features as shown by the line "bb." INPUT considers that the nature of these software systems is such that, while they will retain their innate characteristics over the forecast period, differentiating between the two groups of products will be increasingly difficult.

2. TYPES OF DBMS

- The data base concept was developed by a number of companies in the late 1960s in order to control the proliferation of data files in user installations. Objectives were:

  - Reduce the amount of program maintenance necessary to accommodate application changes.

  - Cross-relate data across many applications to support management information.

- Of the early data base techniques developed, two have become the most widely used techniques today, while the third has been used as a basis for specification of a proposed common data base language. The three data base techniques referred to, and the data base systems which used them, in the late 1960s are:

  - Hierarchical - IBM's Information Management System (IMS).

  - Chained File - IBM's Bill of Material Processor (BOMP).

  - Network - Honeywell's Integrated Data Store (IDS).

- These early data base systems all became available around the 1965-1968 time frame, and formed the basis for most of today's data base systems.

- IBM's Information Management System (IMS) used a data base language referred to as Data Language/I (DL/I). DL/I has become the basis not only for the current version of IMS under OS/VS (IMS/VS), but is also available on DOS/VS systems as DL/I ENTRY and DL/I DOS/VS.

- IBM's Bill Of Material Processor (BOMP) was developed primarily to meet the data base requirements of manufacturing applications. From BOMP was developed IBM's Data Base Organization and Maintenance Processor (DBOMP), with additional enhancements to address needs of manufacturing applications. IBM has de-emphasized DBOMP in favor of DL/I as its prime data base system because of significant advantages which it claims are offered by DL/I over DBOMP.

- An independent development of a data base system which grew from the concepts of BOMP is TOTAL, marketed by Cincom Systems.

- TOTAL and IMS are the two most widely used data base systems today.

- Honeywell's Integrated Data Store was used as the basis for the specifications of a common data base language by the CODASYL Committee.

- Most recently, the relational data base structure has been enjoying widespread publicity. This structure was proposed by Codd of IBM in 1969.

- A relational DBMS provides logical data independence, whereby the application program is not required to have a "knowledge" of the physical structure of the data base. This contrasts with "physical data independence," provided by DBMS, which enables the application program to provide logical processing access to the data base.

- Implementation of the relational DBMS concept is theoretically attractive but difficult in practice:

  - National CSS, among others, has relational features in its NOMAD product.

  - IBM has several relational DBMS under test.

- Initially, relational DBMS can only handle small data bases because of the decrease in response time when larger numbers of relationships are handled. The extent of the practicability of the concept is not yet known.

3. TYPES OF VENDOR

- The early 1970s saw the development of a number of DBMS. These were developed by computer manufacturers, computer users, and independent software companies. In addition, remote computing services firms developed proprietary implementation languages which contained DBMS capabilities.

- Because of the availability of a variety of DBMS from vendors, development by users will be highly unlikely in the future.

- Computer manufacturers currently have about 35% of the installations of DBMS in the U.S.:

  - IBM, with IMS, has the largest number of DBMS installations (1,100) of the computer manufacturers and the highest revenue.

  - Hewlett-Packard and Data General in the minicomputer area offer DBMS; HP has almost as many installations (1,000) for IMAGE 3000 as IBM's IMS.

  - Univac and Honeywell have provided DBMS software to their users without charge.

  - Honeywell introduced the first DBMS package (IDS) in 1963 and has over 700 installations.

  - Burroughs, Control Data, Honeywell, and DEC have all introduced DBMS products in the last two years.

- Independent software companies have been able to take advantage of the lack of availability, and performance and feature problems of the computer manufacturers' products, in order to build the majority market share.

  - Cincom, with TOTAL, has over 30% of the total number of DBMS installations.

  - Few DBMS have been introduced by independent companies in the last five years.

  - One of the few significant, recent announcements has been that of a microcomputer DBMS (MICROSEED) from International Data Base Systems.

- Remote computing services vendors have developed their own implementation languages/DBMS, as CSC, Tymshare, and National CSS have done, or commissioned them from a specialist software company, as CDC/SBC and ADP Network Services have done, or licensed generally available products such as IMS, TOTAL, and System 1022.

  - RCS companies have not sold proprietary DBMS as software packages.

  - Recent announcements by ADP and NCSS indicate that these vendors will sell their software in a "package" with hardware.

  - INPUT expects these vendors to increasingly participate in the software market with such packaged offerings.

B. MARKET FORECAST

1. MARKET STRUCTURE

- INPUT expects the overall market for DBMS packages to expand from $86 million in 1977 to almost $900 million by 1983, as shown in Exhibit III-2. This is an increase of an order-of-magnitude in user expenditures for DBMS.

- Of the total market, approximately half is due to large DBMS systems operating on very large computers. The characteristics of the four size categories of DBMS addressed in this analysis are contained in Exhibit III-3.

2. LARGE DBMS MARKET CONSIDERATIONS

- In the large DBMS area, there are now over 2,000 large computers which have the capacity to process these systems effectively for many user applications.

  - This number will expand to 8,000 by 1983; this is a very conservative estimate based on the "announced" backlog of over 10,000 IBM 303X systems.

  - In this context, the IBM 3031 is categorized as a medium-sized system.

  - INPUT projects that at least 90% of such systems will use large DBMS by 1983.

- Many of these very large computer systems will be obtained for multi-installation sites. Consequently, a discount factor is applied to the purchase price of large DBMS for these installations, since many vendors, notably excluding IBM, offer such discounts.

EXHIBIT III-2

MARKET SHARE BY SIZE OF DBMS, 1977 AND 1983

SIZE OF DBMS	1977				1983			
	NUMBER INSTALLED	%	MARKET SIZE ($ MILLION)	%	NUMBER INSTALLED	%	MARKET SIZE ($ MILLION)	%
LARGE	1,600	25%	$54	63%	7,000	4%	$430	48%
MEDIUM	2,700	43%	$28	32%	13,000	8%	$250	28%
SMALL	2,000	32%	$ 4	5%	60,000	35%	$185	21%
VERY SMALL	—	—	—	—	90,000	53%	$ 25	3%
TOTAL	6,300	100%	$86	100%	170,000	100%	$890	100%

EXHIBIT III-3

CHARACTERISTICS OF DBMS BY SIZE CATEGORY

CHARACTERISTIC	LARGE	MEDIUM	SMALL	VERY SMALL
AVERAGE PURCHASE PRICE				
1977	$100,000	$36,000	$3,000	$1,000
1983	$150,000	$64,000	$6,000	$ 500
(% CHANGE PER YEAR)	7%	10%	12%	(-11%)
AVERAGE LEASE PRICE/YEAR				
1977	$30,000	$10,000	NONE	NONE
1983	$60,000	$18,000	NONE	NONE
(% CHANGE PER YEAR)	12%	10%		
AVERAGE MAINTENANCE COST/YEAR				
1977	$8,000	$3,000	$600	NONE
% PURCHASE PRICE	8%	8%	20%	
1983	$18,000	$6,000	$1,400	NONE
% PURCHASE PRICE	12%	9%	23%	
% CHANGE PER YEAR	15%	12%	15%	
PENETRATION OF COMPUTER BASE				
1977	67%	45%	0.8%	0
1983	90%	80%	6.0%	8% of micro-based computers
SIZE OF COMPUTERS PRIMARILY COVERED	IBM System/370 Model 158 & larger, and equivalents	IBM System/370 Model 135 to Model 155, & equivalents	IBM System/32 & Series/1 to IBM System/370 Model 125	TI9900, INTEL 8080 based system

- On the other hand, vendors are constantly adding features to their DBMS packages and charging for them. Hence, INPUT considers the average purchase price for large DBMS will increase, although the "announced" price increases will be diluted by the discounts mentioned above.

- Maintenance charges are expected to increase at 12% per year, and this is reflected in the increase in lease rates. High labor, travel, and the communications aspect of maintenance are the reasons for escalation in costs.

- Additionally, vendors recognize a benefit to keeping initial purchase price relatively low and boosting maintenance charges, which are at the "noise" level in large installations. Therefore, INPUT projects maintenance costs will increase from about 8% of purchase price in 1977 (less than $1,000 per month) to 12% in 1983 (still only $1,500 per month).

3. MEDIUM-SIZED DBMS MARKET CONSIDERATIONS

- Medium-sized DBMS are, in many cases, smaller versions of the large DBMS:

  - Since most of the DBMS will go into single system sites, discount factors will not apply to average purchase price.

  - Some large DBMS will be run on medium-sized machines and this will tend to increase the average purchase price in this category.

  - Features will also be added at this size level.

  - Since penetration levels are lower than for large DBMS, competition will be less and upward price mobility easier to implement.

  - Consequently, the average purchase price will increase faster than for large DBMS, while lease and maintenance charges will not increase as rapidly.

- In terms of the number of medium-sized computers installed, INPUT projects this to grow at an average annual growth rate of about 18%, with over 16,000 installed by 1983.

- The new range of IBM medium-scale computers to be announced this year (as reported in INPUT's Vendor Watch Report #3) will foster this growth.

4. SMALL DBMS MARKET CONSIDERATIONS

- Small DBMS, such as those available from minicomputer manufacturers, will generally only be available for purchase, not lease.

  - Again, purchase price is expected to increase with new features and low penetration of the potential market.

  - Maintenance at this size level will increase even faster than the purchase price, due to escalating costs and vendor marketing strategies.

- INPUT projects that over one million minicomputers and small business computers will be installed by 1983:

  - This will represent a 43% penetration of the gross market potential for such systems.

  - Small computers in the commercial market will represent approximately 60% of these systems (600,000 units).

  - Approximately 10% of these will be "large" systems.

- The 60,000 systems so identified represent the market for small DBMS:

  - Products used will probably be priced in a similar manner to Hewlett-Packard's IMAGE 3000, i.e., around $6,000 purchase price in 1983.

- Most such products will be purchased.

- Maintenance charges will be at the $50-$100 per month level.

5. VERY SMALL DBMS MARKET CONSIDERATIONS

- There will also be an emerging market for "disposable" software packages which will be implementation languages with imbedded DBMS.

  - These packages will be purchased "off the shelf" for prices in the $50-$1,000 range and will not be "maintained."

  - Such products will be sold through distributors, shops, and mail order systems.

- At the very small (micro) DBMS level, average price will decrease as vendors proliferate.

6. DETAILED DBMS MARKET FORECASTS BY SIZE CATEGORIES

- As shown in Exhibit III-4, growth in the next several years of the DBMS market will be dramatic in all size categories:

  - Largest growth rate will come in 1980 when new hardware-linked DBMS will emerge.

  - Small DBMS expansion in 1980 and succeeding years will be largely fueled by distributed data processing developments.

- With increases in maintenance costs and a movement to purchase DBMS, maintenance expenditures by users will account for 20% of the total in 1983, as shown in Exhibit III-5, up from 9% in 1977.

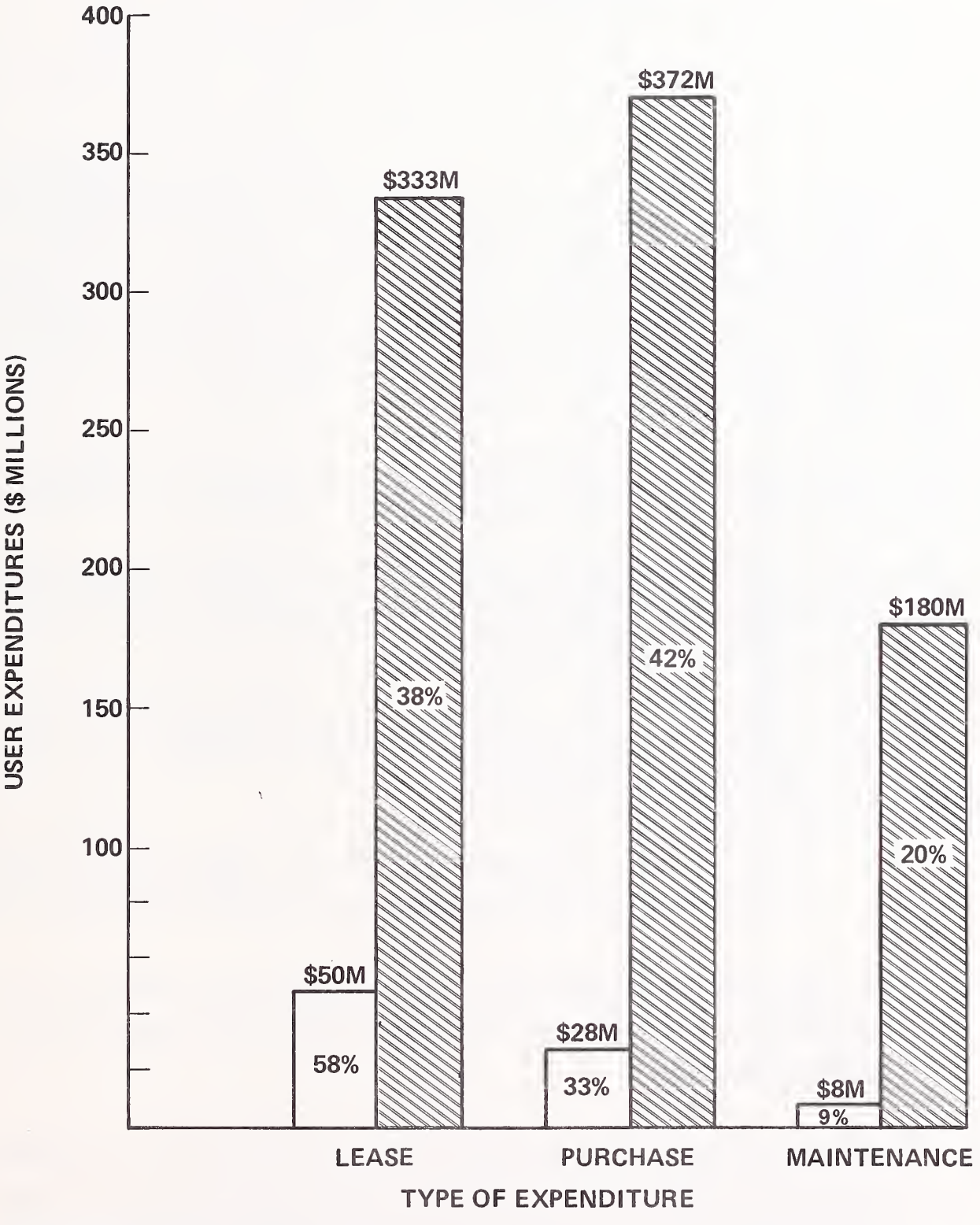
EXHIBIT III-4

DBMS MARKET FORECAST
BY SIZE OF DBMS

SIZE OF DBMS	MARKET SIZE ($ MILLIONS)												
	1977	1978	CHANGE 1977 TO 1978 %	1979	CHANGE 1978 TO 1979 %	1980	CHANGE 1979 TO 1980 %	1981	CHANGE 1980 TO 1981 %	1982	CHANGE 1981 TO 1982 %	1983	CHANGE 1982 TO 1983 %
LARGE	$54	$81	50%	$118	46%	$180	53%	$240	33%	$330	38%	$430	30%
MEDIUM	28	42	50%	65	55%	90	38%	125	39%	180	44%	250	39%
SMALL	4	9	125%	18	100%	60	233%	100	67%	160	60%	185	42%
VERY SMALL	–	0	–	1	–	2	100%	7	250%	12	70%	25	110%
TOTAL	$86	$132	53%	$202	53%	$332	64%	$470	42%	$680	45%	$890	37%

EXHIBIT III-5

LEASE/PURCHASE/MAINTENANCE EXPENDITURES FOR ALL DBMS,
1977 AND 1983



- The shift to purchased systems will be particularly prevalent in large DBMS as shown in Exhibit III-6:
  - Over half of the installed systems will be purchased by 1983.
  - In large part, this will be due to the success of the independent vendors in selling their products to the large EDP departments.
- Medium-sized DBMS will increasingly be purchased, however, since mainframe vendors, notably IBM, will grow most rapidly in this size category and will continue to lease their larger products; it will be 1983 before a balance in shipments between lease and purchase methods of acquisition are obtained. As shown in Exhibit III-7, there will be almost 7,500 leased DBMS of this type by 1983.
- Small DBMS will be primarily supplied by, or through, mainframe vendors:
  - The large number of shipments and low prices forecasted for these DBMS in Exhibit III-8 mean that distribution channels other than the mainframe vendor will be difficult.
  - This provides an opportunity for software companies to associate with vendors of this sized product.
  - There will be strong linkages between the development of products at this size level and large DBMS because of distributed data processing.
- By 1984, close to 100,000 micro DBMS will have been installed, as shown in Exhibit III-9. First shipments of the first of these systems (MICROSEED) are already being made.
- Because of changes in price levels, as well as user methods of acquisition, the proportion of expenditures for lease, purchase, and maintenance of DBMS will vary considerably by size of DBMS as shown in Exhibits III-10 through III-12 .

EXHIBIT III-6

LARGE DBMS: FORECASTED
INSTALLATIONS, SHIPMENTS, AND MARKET, 1977 THROUGH 1983

MARKET CHARACTERISTIC	MARKET COMPONENT	1977	1978	1979	1980	1981	1982	1983
INSTALLED SYSTEMS	LEASED	1200	1450	1700	2000	2350	2800	3300
	PURCHASED	400	550	800	1200	1850	2650	3650
	TOTAL	600	2000	2500	3200	4200	5450	6950
SHIPPED SYSTEMS	LEASED	250	250	300	350	450	500	600
	PURCHASED	150	250	400	650	800	1000	1100
	TOTAL	400	500	700	1000	1250	1500	1700
EXPENDITURES FOR LEASED DBMS	NUMBER	1200	1450	1700	2000	2350	2800	3300
	PRICE*	30	34	38	42	47	53	60
	MARKET**	36	49.3	64.6	84.0	110.4	148.4	198.0
EXPENDITURES FOR PURCHASED DBMS	NUMBER	150	250	400	650	800	1000	1100
	PRICE*	100	107	114	122	130	140	150
	MARKET**	15	26.8	45.6	79.3	104.0	140.0	165.0
EXPENDITURES FOR MAINTENANCE ON PURCHASED BASE	NUMBER	400	550	800	1200	1850	2650	3650
	PRICE*	8	9	10	12	14	16	18
	MARKET**	3.2	5.0	8.0	14.4	25.9	42.4	65.7
TOTAL MARKET**		$54.2	$81.1	$118.2	$177.7	$240.3	$330.8	$428.7

*PRICE IN $THOUSANDS
**MARKET IN $MILLIONS

EXHIBIT III-7

MEDIUM-SIZED DBMS: FORECASTED
INSTALLATIONS, SHIPMENTS, AND MARKET, 1977 THROUGH 1983

MARKET CHARACTERISTIC	MARKET COMPONENT	1977	1978	1979	1980	1981	1982	1983
INSTALLED SYSTEMS	LEASED	1350	1870	2570	3470	4490	5690	7490
	PURCHASED	1350	1630	2030	2630	3310	4110	5310
	TOTAL	2700	3500	4600	6100	7800	9800	12,800
SHIPPED SYSTEMS	LEASED	520	700	900	1020	1200	1800	1250
	PURCHASED	280	400	600	680	800	1200	1250
	TOTAL	800	1100	1500	1700	2000	3000	2500
EXPENDITURES FOR LEASED DBMS	NUMBER	1350	1870	2570	3470	4490	5690	7490
	PRICE*	10	11	12	13	15	16	18
	MARKET**	13.5	20.6	30.8	45.1	67.4	91.0	134.8
EXPENDITURES FOR PURCHASED DBMS	NUMBER	280	400	600	680	800	1200	1250
	PRICE*	36	40	44	48	53	58	64
	MARKET**	10.1	16.0	26.4	32.6	42.4	69.6	80.0
EXPENDITURES FOR MAINTENANCE ON PURCHASED BASE	NUMBER	1350	1630	2030	2630	3310	4100	5310
	PRICE*	3	3.4	3.8	4.2	4.7	5.3	6.0
	MARKET**	4.0	5.5	7.7	11.1	15.6	21.8	31.9
TOTAL MARKET**		$27.6	$42.1	$64.9	$88.8	$125.4	$182.4	$246.7

*PRICE IN $THOUSANDS
**MARKET IN $MILLIONS

EXHIBIT III-8

SMALL DBMS: FORECASTED
INSTALLATIONS, SHIPMENTS, AND MARKET, 1977 THROUGH 1983

MARKET CHARACTERISTIC	MARKET COMPONENT	1977	1978	1979	1980	1981	1982	1983
INSTALLED SYSTEMS	LEASED	–	–	–	–	–	–	
	PURCHASED	2000	3000	5000	9000	21000	37000	59000
	TOTAL	2000	3000	5000	9000	21000	37000	59000
SHIPPED SYSTEMS	LEASED	–	–	–	–	–	–	–
	PURCHASED	1000	2000	4000	12000	16000	22000	17000
	TOTAL	1000	2000	4000	12000	16000	22000	17000
EXPENDITURES FOR LEASED DBMS	NUMBER							
	PRICE*			N/A				
	MARKET**							
EXPENDITURES FOR PURCHASED DBMS	NUMBER	1000	2000	4000	12000	16000	22000	17000
	PRICE*	3	3.4	3.6	4.2	4.8	5.4	6.0
	MARKET**	3.0	6.8	14.4	50.4	76.8	118.8	102.0
EXPENDITURES FOR MAINTENANCE ON PURCHASED BASE	NUMBER	2000	3000	5000	9000	21000	37000	59000
	PRICE*	0.6	0.7	0.8	0.9	1.05	1.2	1.4
	MARKET**	1.2	2.1	4.0	8.1	22.0	44.4	82.6
TOTAL MARKET**		$4.2	$8.9	$18.4	$58.5	$98.8	$163.2	$184.6

*PRICE IN $THOUSANDS
**MARKET IN $MILLIONS

EXHIBIT III-9

VERY SMALL DBMS: FORECASTED
INSTALLATIONS, SHIPMENTS, AND MARKET, 1977 THROUGH 1983

MARKET CHARACTERISTIC	MARKET COMPONENT	1977	1978	1979	1980	1981	1982	1983
INSTALLED SYSTEMS	LEASED							
	PURCHASED							
	TOTAL	–	–	100	1100	4100	14100	34100
SHIPPED SYSTEMS	LEASED	–						
	PURCHASED	–	100	1000	3000	10000	20000	50000
	TOTAL	0	100	1000	3000	10000	20000	50000
EXPENDITURES FOR LEASED DBMS	NUMBER							
	PRICE*			N/A				
	MARKET**							
EXPENDITURES FOR PURCHASED DBMS	NUMBER	–	100	1000	3000	10000	20000	50000
	PRICE*	–	1	0.9	0.8	0.7	0.6	0.5
	MARKET**	0	0.1	0.9	2.4	7.0	12.0	25.0
EXPENDITURES FOR MAINTENANCE ON PURCHASED BASE	NUMBER							
	PRICE*			N/A				
	MARKET**							
TOTAL MARKET**		$0	$0.1	$0.9	$2.4	$7.0	$12.0	$25.0

*PRICE IN $THOUSANDS
**MARKET IN $MILLIONS

EXHIBIT III-10

LEASE/PURCHASE/MAINTENANCE EXPENDITURES FOR LARGE DBMS,
1977 AND 1983

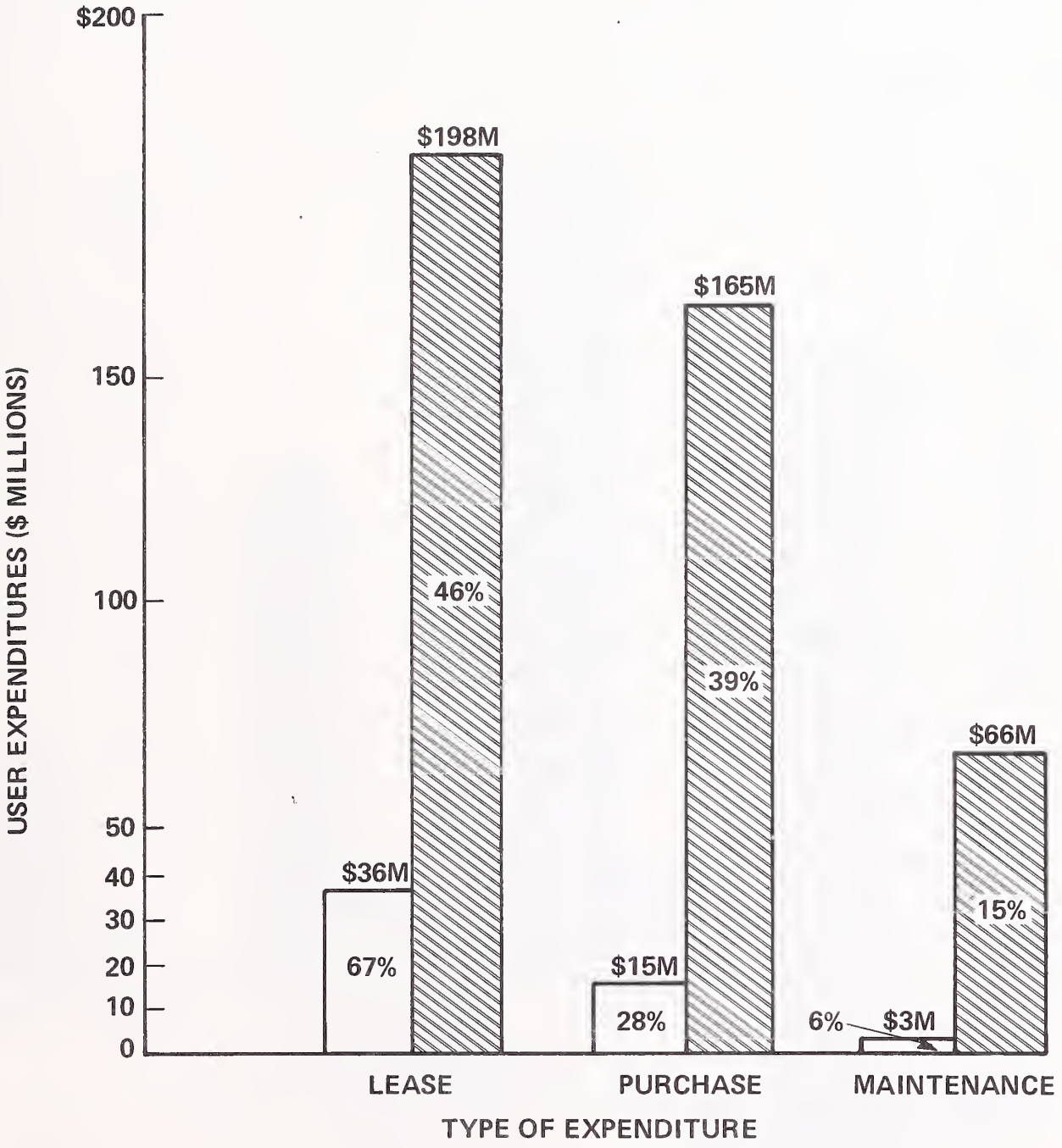


EXHIBIT III-11

LEASE/PURCHASE/MAINTENANCE EXPENDITURES FOR MEDIUM SIZED DBMS, 1977 AND 1983

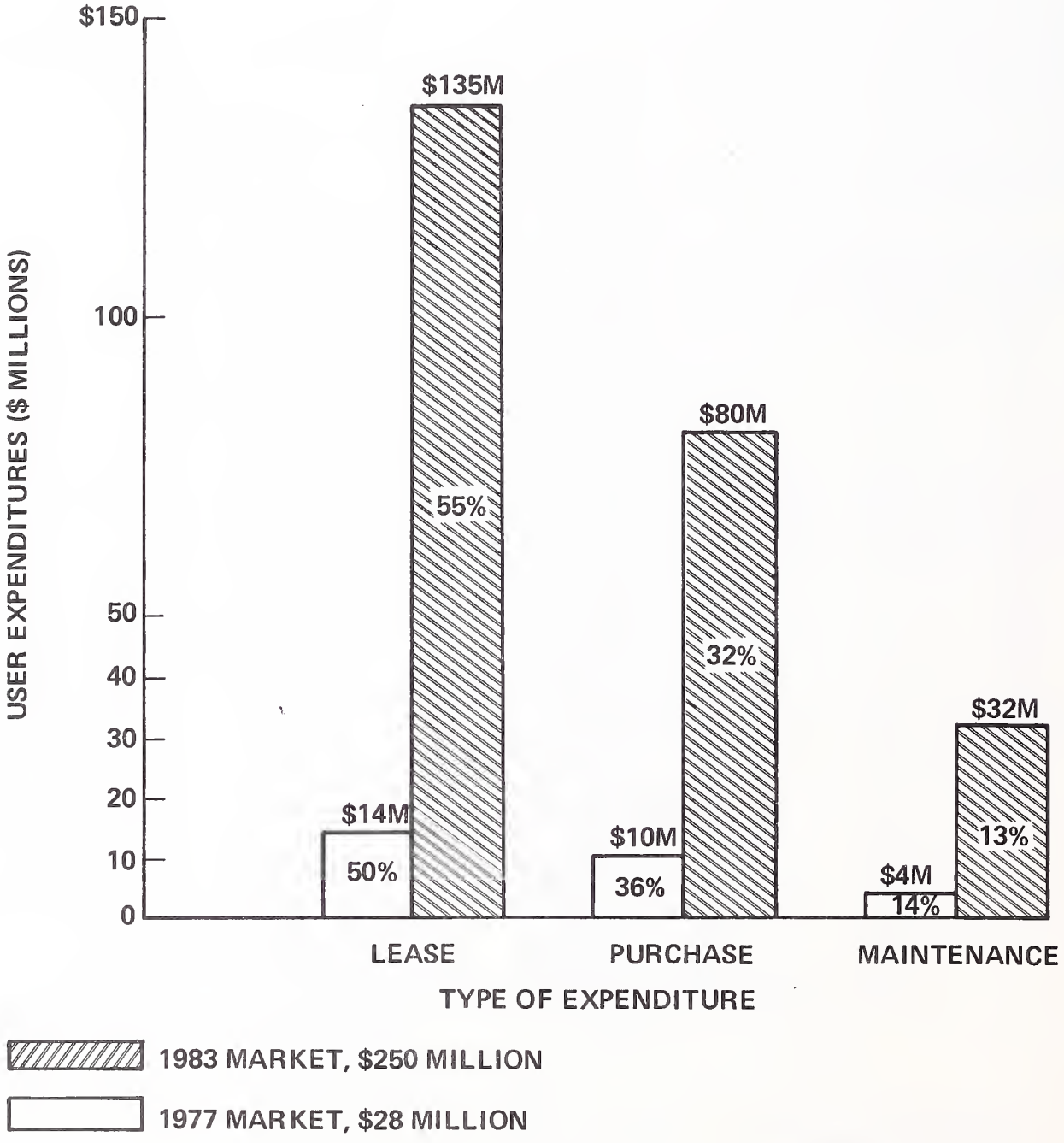
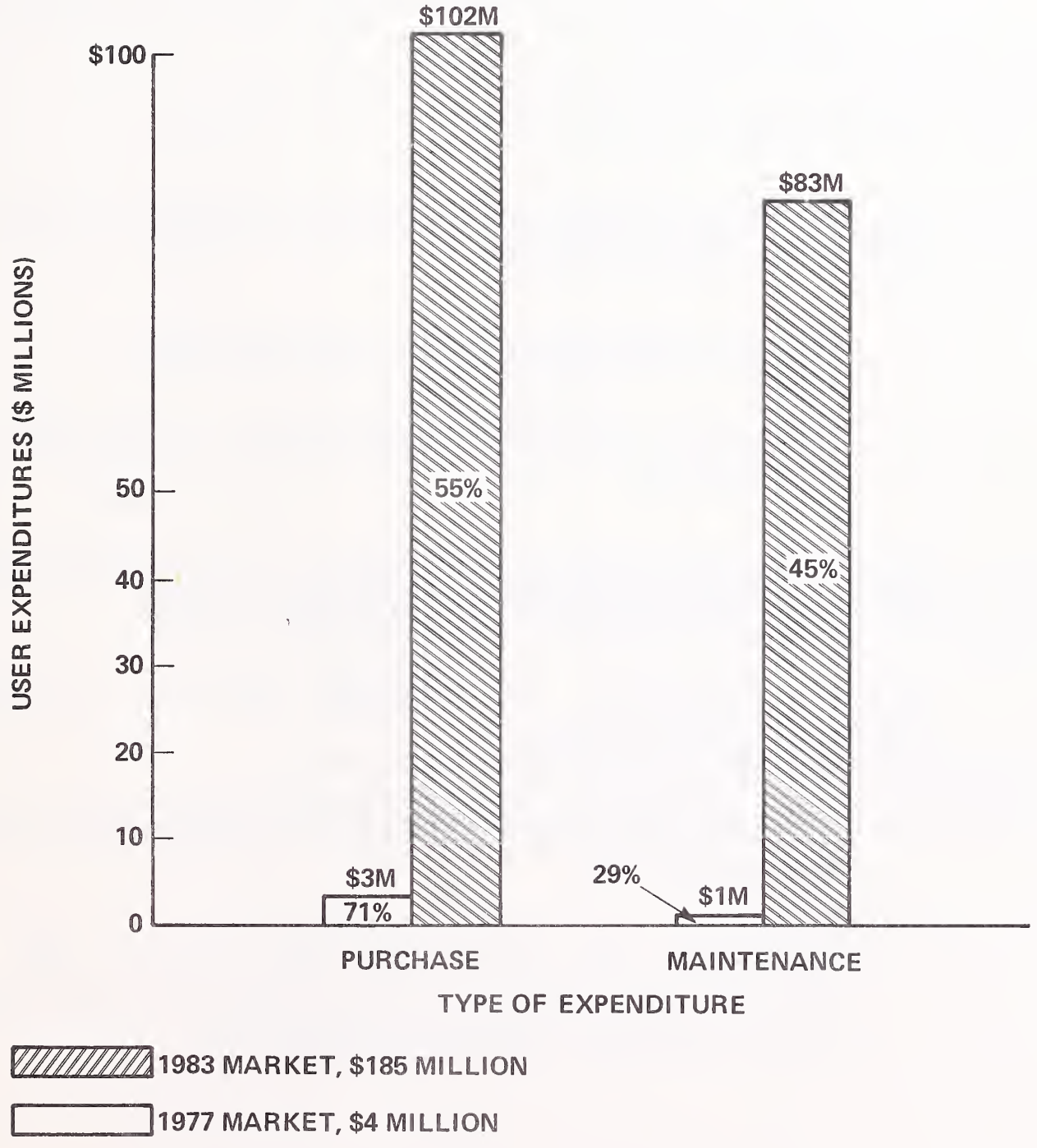


EXHIBIT III-12

PURCHASE/MAINTENANCE EXPENDITURES FOR SMALL DBMS,
1977 AND 1983



- The effect of maintenance cost increases is shown most vividly for small DBMS where almost half of the user expenditures in 1983 will be for maintenance.

- Charging policies in DBMS will reflect the "razor blade" market approach, where the razor is "given away" and premiums charged for the blades.

- In order to build the maintenance market, vendors must build their user base rapidly.

7. MARKET SHARE BY VENDOR TYPE

- Data base software vendors must be sensitive to advances in technology, software, and network architecture:

  - Most of their systems are based on 15 year-old concepts.

  - Pressure is to improve old, and perhaps obsolete, products rather than develop new ones.

- Basically, the problems IBM has had with IMS and the lack of concern IBM has shown about these problems has enabled other DBMS to prosper.

- Computer manufacturers are increasingly sensitive to combined hardware/software development:

  - Honeywell, Control Data, Burroughs and DEC have all announced new DBMS in recent years.

  - New offerings will emanate from these companies, IBM, and "technology" companies such as Texas Instruments, Intel, and Fairchild, perhaps in conjunction with software organizations.

- As a result, the share of the DBMS market that computer manufacturers will have will increase significantly, as shown in Exhibit III-13.

- New systems from IBM will obsolete current DBMS at the conceptual and operational levels:

  - Mid-range hardware to be announced in 1978 by IBM will contain a relational DBMS.

  - The new range of large-scale hardware in the early 1980s will incorporate a new DBMS with integrated hardware/firmware/software features.

  - IMS will continue to be supported, and probably emulated, on the new system.

  - As an interim step, CICS and IMS/DLI will be merged.

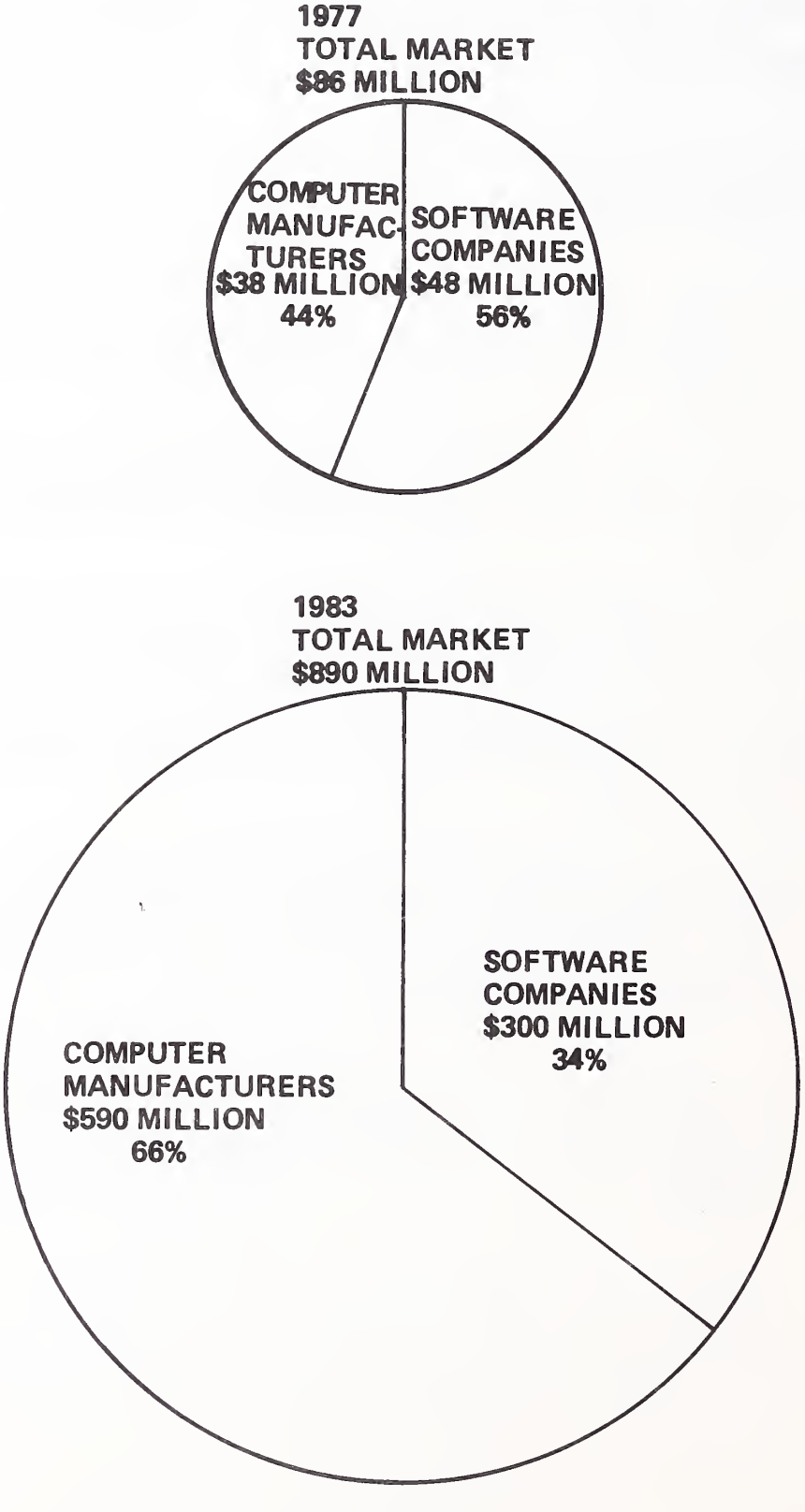
- Processing services companies have had little participation in the software market, in the past:

  - Recent announcements by ADP and National CSS of on-site, time-sharing systems using their proprietary DBMS/implementation languages are steps in a new direction.

  - All such announcements to date suffer from the "problem" of using "old" hardware. None of them have matched new hardware and software concepts.

EXHIBIT III-13

SOFTWARE COMPANIES' AND COMPUTER MANUFACTURERS' SHARE OF THE DBMS MARKET, 1977 AND 1983



C. IMPACT OF CHANGING TECHNOLOGY

1. DISTRIBUTED DATA BASE TRENDS

- The next five to ten years will see further emphasis on distributed data bases, first based on the larger minicomputers, and then migrating down to the smaller minicomputers and to microcomputers.

- As the technology develops, there will be a wider distribution of processing function than is presently realized:

  - The current distributed data processing (DDP) techniques are generally based upon the use of a centralized data base.

  - While some limited capability is provided in a stand-alone environment, full processing flexibility is only realized in reference to the centralized data base.

- Distributed data bases (using full DBMS) will increase the autonomy of each distributed location, in its ability to manage and manipulate its own data. There will still be a requirement for central control of the various distributed data base nodes, for consolidation of the various remote data base processing activity into a high-level, centralized, organizational data base.

- Such an organizational data base generally will contain summary data, rather than the detailed operating data required for the day-to-day functioning of the various distributed locations.

- This evolution of distributed data base will tend to follow the typical management reporting levels in an organization:

- These distributed data base systems will provide day-to-day operating data required by first line management.

- This data will be consolidated and summarized for the requirements of higher level management.

- Eventually, the key management information required for corporate decision-making will be available.

- In the first instance, a distributed data base may tend to off-load a considerable amount of data base processing to the distributed locations. This will increase the capability of the central host system to effectively consolidate the various organizational data.

- The trend to distributed data bases will substantially affect the market for DBMS software:

  - Each node will require a DBMS compatible with the central system.

  - Current DBMS software will have to be replaced or upgraded to effectively work in a DDP environment.

- Both the above factors will tend to increase market size. Vendors will price DBMS in a DDP environment on a price-per-node basis in addition to a central site charge.

2. DATA BASE COMPUTERS ("BACK-END" DBMS PROCESSORS)

- The concept of a front-end communications controller has become an accepted fact of data processing today. Such a front-end controller off-loads much of the processing previously carried out by the host system to control the transmission of data to and from remote devices.

- A similar development will emerge over the next few years towards the back-end DBMS controller.

- Current development is under way by Cullinane, Cincom, and others in the migration of their DBMS from a host mainframe to a minicomputer, channel-connected to the mainframe. Such a channel-connected minicomputer provides a back-end DBMS capability.

- Back-end DBMS offers the advantage of uniquely designed minicomputers, capable of accessing data bases in the billion byte size range:

  - Such specialized minicomputers can be microcoded to support a unique instruction set which provides processing capability equal to, and in some cases exceeding, the processing capability of large mainframes using a generalized instruction set.

  - In fact, in order to obtain the necessary performance characteristics, such microcoding will be mandatory.

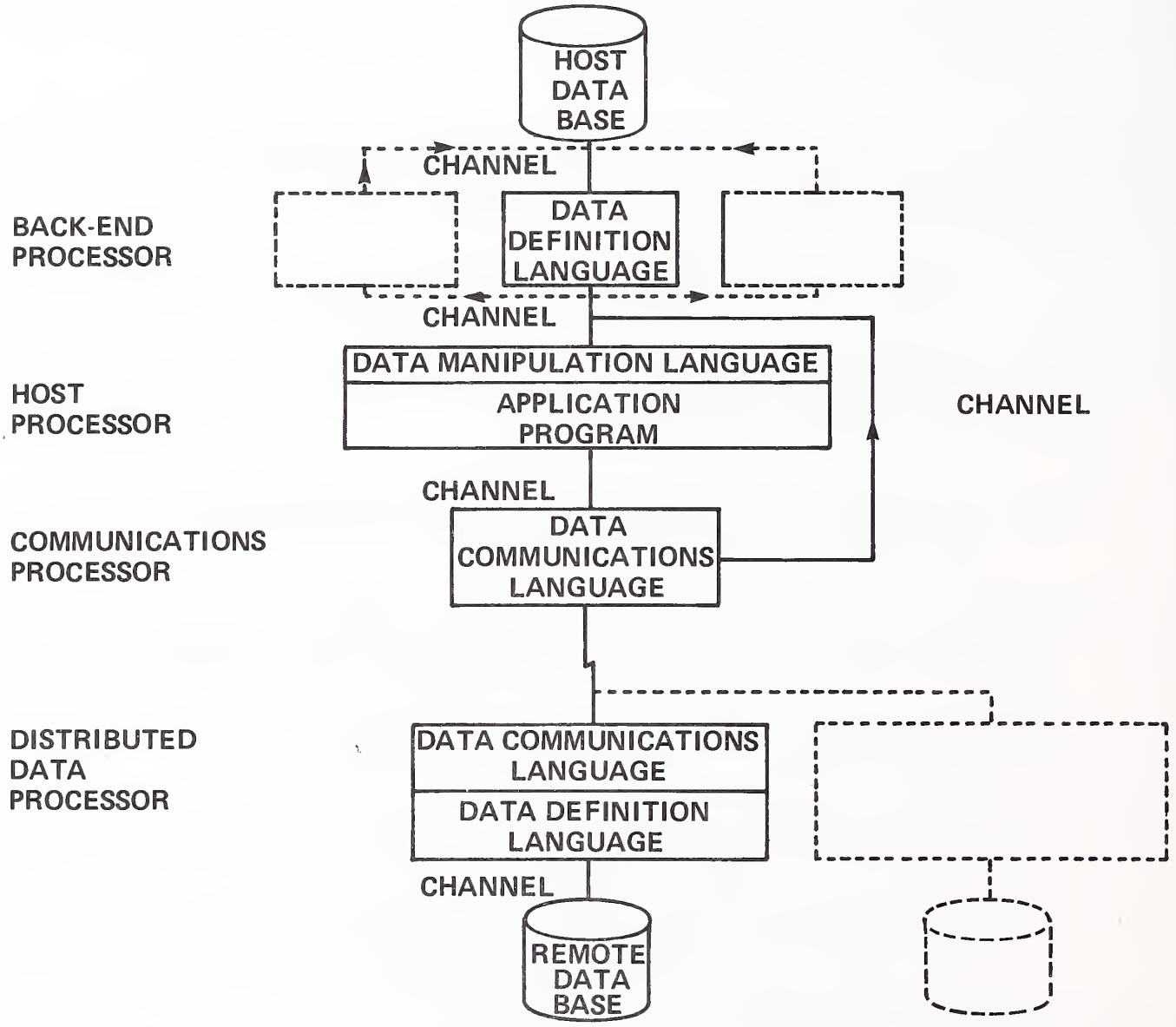
- The back-end contains the data base management system and supports the data base according to the physical data base specifications indicated by the Data Definition Language (DDL), as shown in Exhibit III-14.

- The host mainframe, on the other hand, processes on-line and batch application programs, which continue to request data base operations through the Data Manipulation Language (DML). Such DML requests are intercepted by a DML interface routine in the mainframe, and then communicated across the channel to the back-end DBMS.

- The back-end DBMS interprets the DML command, accesses the data base using the DDL schema, and passes the requested data across the channel to the mainframe. Subsequent processing in the mainframe may return that data to the minicomputer for subsequent update of the previously retrieved data base records.

EXHIBIT III-14

DBMS ORGANIZATION IN A DISTRIBUTED
AND BACK-END PROCESSING ENVIRONMENT



- The logical interface between the application program and the DBMS is through the Data Manipulation Language. The DML in general permits a separation between the logical accessing of a data base by application programs, and its physical organization as defined through the Data Definition Language, and represented in the schema.

- Through the capability of microcomputers, relatively inexpensive multi-processors and array processors will emerge for many DBMS functions that are currently provided in one system.

- A number of benefits result from the use of a back-end DBMS:

  - Improved Cost/Performance: The lower cost associated with mini/micro computers, with the added advantage of specially micro-coded instruction sets which offer high DBMS performance, present a new perspective to the cost/performance of data base management systems. Overhead associated with large mainframes can be reduced in this environment. The more processing that can be off-loaded to the back-end processor, the greater are the potential savings in the host mainframe in terms of CPU time and memory.

  - Increased Work Load: As the application work load introduced to a mainframe increases, the need to maintain a certain level of response may dictate the upgrading of that mainframe to a higher performing model at great expense. Off-loading DBMS processing to a back-end processor may offset the need for such an upgrade.

  - Increased Storage Requirements: As application workloads increase, so also may the demands on the storage capability of the host mainframe. Off-loading of a DBMS to an attached back-end minicomputer can relieve a high demand for storage resources in the mainframe, and free this storage for increased applications processing.

- Secondary Storage Interfaces: Various secondary storage devices can be connected to a back-end processor, which in turn is capable of connection to a variety of different host mainframes. The need to interface new storage technologies with each different host mainframe is removed. Such interfacing need be done only once for the back-end minicomputer, and so made available to all of the host mainframes which can connect that DBMS minicomputer.

- There are some potential disadvantages of back-end DBMS:

  - Multiple Vendors: In many cases, the host mainframe and the back-end minicomputer may be supplied by different vendors, so introducing the multiple vendor maintenance problem.

  - Obsolescence: While a back-end processor can enable a host mainframe to take advantage of new technological developments, such a back-end may constrain the ability of an organization to move to a new mainframe environment which is not capable of connecting to the back-end DBMS.

  - Reliability: The more individual components involved in a system, the higher the probability of failure of a component in that system and, consequently, the lower is the mean time to failure of the entire system.

  - Performance: The prediction and measurement of performance for a DBMS is a very complex task based on today's mainframe DBMS products. The addition of a back-end DBMS processor adds a further level of complexity when measuring performance, and tuning the DBMS between the mainframe and the attached minicomputer DBMS processor. (Cullinane found performance to be worse in their experimental back-end computer, which did not make extensive use of custom microcode.)

- A back-end processor can be a very large and powerful computer. Indeed, for very large user data base requirements, such processors will be used. The main advantages to these users are:

  - Reduction in overhead through separation of function.

  - Improvement in performance through use of microcode.

- Note should be made that mainframe manufacturers, such as IBM, can provide the back-end processor, applications processor, and/or communications processor in the same "box," minus the external channels.

- The emergence of the back-end DBMS processor will affect the DBMS market in several ways:

  - Reduce the market for stand-alone DBMS operating only on large and medium-sized host systems.

  - Significantly increase user expenditures directly attributable to DBMS.

- INPUT projects the potential market for independent (i.e., non-IBM), back-end DBMS processors is about $60 million per year in 1978. Actual penetration of this market in 1978 is minimal.

- By 1983, INPUT projects the potential market for independent, back-end DBMS processors to be between $220 million and $300 million. Actual penetration will be between $150 and $200 million.

- These market sizes apply to system sales where hardware and software are included.

- Word and text processing systems are underestimated in the importance of their impact on DBMS:
  - Digitizing of images will enable full integration of graphics, text, and data.
  - Over 80% of large users see this integration taking place.
  - There will be a movement to true IBMS (Information Base Management Systems).
  - Data processing managers will be involved in these developments, as also will be the data base administrators.
- Consequently, in the 1980s the market for DBMS/IBMS will continue to expand very rapidly.

3. STORAGE, COMMUNICATIONS, AND OTHER DEVELOPMENTS

- INPUT expects the emergence of massive data base storage capability in the next five years:
  - Storage techniques other than rotating disks, including CCD and bubble technology will be used.
  - Addressing capability of 32 bits or more will be used.
  - On-line storage of 100 billion bytes of information with performance capacity better than disk will be available.
  - Eventually, software and data will reside together in main memory.
  - By 1985 it will be cheaper to store information in memory than on paper.

- This massive data base capability will be used not only for very large data bases, but also for myriads of small data bases.

- Back-end DBMS processors will have some advantage in connecting such devices to host computers because of the potential impact of such systems on existing applications programs.

- A requirement to convert existing applications programs to use new technology may represent an overwhelming impediment to effective use of such technology.

- Privacy and security will be issues which will feed the need for mass storage. Security will be implemented through use of a systems dictionary concept:

  - System dictionaries are the key to future development of DBMS.

  - A system dictionary may, in fact, be a processor.

- Automated Application Development Systems (AADS) will be structured around applications dictionaries, which will store all input/output display formats, conditional logic, and processing rules.

- IBM's SNA has slowed the trend to distributed data processing. By 1980, this restriction will be removed as IBM delivers a new communications product line replacing 370X/3790 systems.

- Also in communications, Satellite Business Systems and other wide-band carriers will enable massive data base transfer to occur economically.

IV ANALYSIS OF USERS

IV ANALYSIS OF USERS

A. GENERAL CHARACTERISTICS OF FIRMS SURVEYED

- The DBMS user interview sample consisted of 258 firms. A combination of on-site, telephone, and mail questionnaires were used as defined in Appendix A.

- Seventy-five firms were interviewed in depth, either on-site or by telephone. Of these, 65% had a DBMS installed.

- INPUT selected companies with medium to large scale data processing operations to participate in the in-depth interviews.

- The mail questionnaires were sent to companies in the Fortune 1000 and 50's lists.

1. FIRMS WITHOUT DBMS INSTALLED

- Of the 26 companies (35% of the sample) interviewed on-site or by phone who did not have have a DBMS installed:

  - Fifteen stated they did not have any plans to install a DBMS.

  - Six stated they were investigating DBMS alternatives and planned to install one in the near future.

- Four stated they were using a DBMS on a remote computing network.

- One stated they previously had a DBMS but terminated the lease because the DBMS had proved ineffective.

- Respondents who did not have any plans to install a DBMS stated the following reasons:

  - "Company is not large enough to support a DBMS."

  - "Don't feel we need one."

  - "Doesn't suit our particular application."

  - "Investigated several DBMS and are afraid of the overhead."

  - "Nothing suitable on the market."

  - "Still waiting for one we'd like. All the ones on the market are too complex."

  - "DBMS are too difficult to install and maintain."

  - "DBMS are still too expensive."

2. FIRMS WITH DBMS INSTALLED

- Exhibit IV-1 summarizes the distribution of the DBMS products among the companies interviewed and the average length of installation.

  - Eighty percent of the installations interviewed had installed one of the top 4 DBMS products.

EXHIBIT IV-1

DISTRIBUTION OF INSTALLED DBMS PRODUCTS
AND AVERAGE LENGTH OF INSTALLATION

NAME OF DBMS	NO. OF SITES INTERVIEWED	% OF TOTAL	AVERAGE YEARS OF DBMS INSTALLATION
IMS	18	38%	3.0
IDMS	8	16	2.5
TOTAL	8	16	4.5
ADABAS	5	10	1.0
SYSTEM 2000	2	4	2.0
DATACOM/DB	1	2	1.0
UNIVAC DMS	1	2	5.0
MINI BASED DBMS	4	8	2.0
IN-HOUSE DEVELOPED DBMS	2	4	6.0
TOTAL	49	100%	3.0

- The length of installation of the DBMS products ranged from 8 years to systems installed as recently as the first quarter of 1978. The average length of installation of the DBMS users' interviewed was 3 years.

- In-house developed DBMS had the longest average installation time.

B. THE DBMS SELECTION PROCESS

1. DBMS PRODUCT EVALUATION

- Seventy-one percent of the companies with a DBMS installed reported they had conducted an extensive analysis of DBMS products before making a final decision. This is evidence that:

  - The DBMS market is highly competitive.

  - DP Managers are concerned about the impact of a DBMS and carefully examine alternatives on an analytic basis before making their final selection.

- Reasons cited by the companies who did not perform an extensive evaluation (29% of the respondents) of DBMS products were:

  - Hardware compatability problems and only one or two products were available.

  - Very few products around at the time.

  - Loyalty to their hardware manufacturer. (As expected, the majority who responded in this manner were IBM installations.)

- Exhibit IV-2 tabulates DBMS products that were considered but not selected. User reasons for selection or rejection of specific products are presented in later sections of this chapter.

  - The high number of mentions (21) for TOTAL reflects the wide exposure of this product.

2. DBMS SELECTION CRITERIA

- When asked what prompted their company to purchase a DBMS, almost three quarters of respondents stated the decision was based on a particular application requirement.

- All of the applications cited required on-line capabilities. This was the prime driving force for selecting a DBMS.

- Companies who did not cite a particular application as the reason for buying a DBMS justified the purchase for one of the following reasons:

  - "Wanted data independence from programs."

  - "Needed a system to manage data for the future."

  - "Reduce program maintenance."

  - "Easy for non-programmers to use."

  - "Applications can be brought up faster."

  - "Query language - users wanted access to their data bases."

  - "Reduction of redundant files."

EXHIBIT IV-2

DBMS CONSIDERED BUT NOT SELECTED
BY RESPONDENTS

NAME OF DBMS	NO. OF MENTIONS	NAME OF DBMS	NO. OF MENTIONS
TOTAL	21	INQUIRE	1
IMS/CICS	16	VARIAN	1
SYSTEM 2000	13	DATACOM	1
ADABAS	11	SYSTEM 1022	1
IDMS	8	DBMS 10	1
IDS	2	IMAGE	1
RAMIS	2	IQL	1
GIM (TRW)	1	INFOS	1
DMS (UNIVAC)	1	TOTAL NO. OF MENTIONS	83

- One respondent stated, with evident honesty, they bought one because they believed "all the propaganda about DBMS capabilities."

- The problem of coordinating the evaluation of DBMS alternatives among multiple EDP installations in a large corporation was particularly evident in one respondent:

  - They unknowlingly purchased the same package on three separate occasions.

  - They admitted this was more a reflection of lack of management than being enamored with the product.

3. DECISION MAKERS IN THE SELECTION PROCESS

- Forty-six percent of the respondents stated the EDP Manager had the authority to recommend and buy a DBMS.

- One quarter of the respondents stated the EDP Manager could recommend the purchase, but the final decision rested with upper management, usually at the vice-presidential level.

- The final quarter of the respondents stated that the decision was made by a committee or by council members. (The committee decisions were confined to government and educational institutions.)

4. USE OF DBMS ON REMOTE COMPUTING SERVICES (RCS)

- An alternative to installation of a DBMS in-house is to use a DBMS on an RCS. To further understand this alternative, users were queried on the use of an outside RCS supplied DBMS service prior to acquisition of their own DBMS:

  - Only 9% (4 of 44) of the users had used an RCS supplied DBMS prior to acquiring their own.

- Since many RCS DBMS products are proprietary and cannot be brought in-house, e.g., Tymshare's MAGNUM, the DBMS brought in-house is often in addition to the RCS service.

- When a DBMS on an RCS service is brought in-house, most companies felt the decision was based on cost, but could not define the cost differential.

- In conclusion, data processing managers appear to be knowledgeable about the capabilities of DBMS products and thus do not "try one out on an RCS before bringing it in-house."

  - Also, the threat to RCS vendors of losing revenues due to migration in-house is not great, particularly if they offer a proprietary DBMS.

  - For a detailed analysis, refer to INPUT's 1977 study, "Remote Computing Services Markets Based On Data Base Management Systems."

5. AN EXAMPLE OF A DETAILED USER ANALYSIS

- The actual amount of analysis which EDP Managers invested in the DBMS selection process varies. An extensive individual analysis done by an EDP Manager interviewed for this study is presented in the following section; it is an example of the analysis being performed by some user organizations:

  - Exhibit IV-3 details a portion of the products evaluated in 1977 and the characteristics of each product as viewed by the EDP Manager. As shown by the exhibit, the technical analysis of products under consideration was extensive. (In fact, the EDP Manager actually evaluated 54 products in this level of detail.)

EXHIBIT IV-3

AN EDP MANAGER'S EVALUATION OF DBMS PRODUCTS

NAME OF DBMS	YEAR INTRO-DUCED	DDL											DML						
			ACCESS			STRUCTURE							SR					SET	
													QL						
													PL		RW			M	PP
		SCHEMA	SEQ	IND SEQ	HASH	TUPLE	HIER	COD	INV	EXT	TAB	REL PTR	HPL	DBPL	RW	RW & PL	RW & REL		
ADABAS	1971	•		•	•				•			•	•		•				
DBMS 10	1973	•	•	•	•			•					•						
DMS - II	1976	•	•	•	•		•			•	•	•	•		•	•	•		
DMS 170	1976	•		•	•		•			•		•	•		•		•		
DMS 1100	1971	•	•	•	•			•					•						
DPL	1975	•	•	•					•						•				
DATACOM/DB	1971	•	•	•			•		•				•		•			•	
FOCUS	1976	•	•	•			•			•		•	•		•	•	•	•	•
IDMS	1973	•	•	•	•			•				•	•						
IDS	1963	•	•	•	•			•					•						
IMS	1968	•	•	•			•				•	•	•						
IMAGE 3000	1974	•	•				•					•	•		•			•	
INQUIRE	1969	•	•	•					•			•	•		•		•	•	•
MODEL 204	1971	•	•	•		•			•					•	•				
RAMIS	1967	•	•	•			•			•		•	•		•	•	•	•	•
SYSTEM 1022	1973	•	•	•					•				•	•	•		•	•	
SYSTEM 2000	1972	•		•			•		•				•		•			•	
TOTAL	1970	•	•	•			•					•	•						

- At the conclusion of his evaluation, the EDP Manager selected none of the products listed, but rather selected a proprietary DBMS offered as a service by a remote computing services vendor, because of some unique qualities of that DBMS.

- The terms used in Exhibit IV-3 were defined by the EDP Manager as follows:

  - SCHEMA: Has a schema or at least a means to describe fields within files.
  - SEQ: Sequential access.
  - IND SEQ: Indexed sequential; random access and indices.
  - HASH: Stored using a hashing function.
  - TUP: Tupple; non-structured file.
  - HIER: Hierarchy, tree structure.
  - COD: CODASYL structure.
  - INV: Inverted keys.
  - EXT: Report writer can read non-data base files.
  - TAB: Table lookup.
  - REL PTR: Relational pointer; pointer between files using common key.
  - SR: Single record handling
  - SET: Set of records.
  - QL: Query language.
  - PL: Procedural language.
  - RW: Report writer; at least capability to print fields with headings, totals and sort.
  - M: Special maintenance procedures; at least a utility to add, delete or modify fields.
  - PP: Preprocessor to alter data base request before interpretation.
  - HPL: Host procedure language such as COBOL or FORTRAN with calls.

- DBPL: Data base procedural language.
- RW&PL: Report writer that has user exit code in a host procedure language to handle single records.
- RW&REL: Report writer and relational feature; at least a capability to match different data bases using keys in both.

C. WHY A SPECIFIC DBMS PRODUCT WAS SELECTED

1. IMS

- The paramount selection criterion of IMS installations was the support provided by IBM. When compared to the selection criteria of other DBMS products, companies who selected IMS were less concerned with system features and technical capabilities.

- Following is a representative sample of responses from IMS users:

  - "Although we knew it would cost more, IBM provides good support and the IMS User Group is very active in our area."

  - "We're an all IBM hardware installation. Serviceability and accessability of IBM's technical staff was the key element."

  - "We're an IBM shop. Their data communications software and data structure seemed to fit our application the best."

  - "We knew the initial installation would be difficult but thought it would pay off in the long run. We also had a very complex data base and thought IMS could handle it."

- "Vendor stability. Being able to run on IBM equipment and matching hardware to the software was important to us."

- "We are very IBM rooted. We wanted to stay current with the IBM operating system. We thought it was the cleanest package available at the time."

2. IDMS

- IDMS users were more concerned about the technical capabilities of the product and wanted one that met the CODASYL standard. Comments from IDMS users were:

  - "We previously had IMS installed. We replaced it with IDMS. We wanted multiple point data access and concurrent batch/on-line capability. IDMS's network structure was the main reason."

  - "We wanted a query capability and a system which uses less core than IMS."

  - "Our staff has had experience with most of the DBMS products on the market and thought IDMS was the best all around package."

  - "We prefer network structure over hierarchical. IDMS was one of the first with CODASYL approved commands."

  - "Ease of use for programmers. We liked the network structure of IDMS."

3. TOTAL

- The main appeal of TOTAL was its efficiency and ease of use. Portability (ability to use on a remote computing service or in-house) was also a consideration in the selection process. User comments were:

- "We spent three months seriously investigating DBMS products. We required vendors to bring their products in and show us how they would work on our system. Although TOTAL did not meet our application needs, Cincom was the only one who could make it work. Other vendors had a good story but no action - no results."

- "We have a Honeywell 2000 and TOTAL was the only DBMS available."

- "We purchased TOTAL as an alternative to ISAM (Index Sequential Access Method). We felt we would have better hardware efficiency. We use it more as an access method than a data base."

4. ADABAS

- The inverted file structure of ADABAS was the feature most frequently cited selection criterion. User comments included:

  - "We are currently in the process of replacing DL/I with ADABAS. Under DL/I, we had to maintain on-line and batch versions. It is a single stream product and cumbersome to use. Fixes were incredibly difficult. ADABAS is a much more powerful product."

  - "We selected ADABAS for its simplicity and ability to interface with other systems. The relational data structure was also a critical factor in the selection process."

  - "We wanted an inverted file system."

  - "We had access to various benchmarks of DBMS products. ADABAS had better performance in the inquiry environment. ADABAS is easier to maintain than IMS. It does not require as many system programmers."

  - "We selected it for its simplified query language and inverted file structure."

5. SYSTEM 2000

- The reasons for selecting System 2000 by the two companies interviewed were:

  - "It is more user oriented. Less systems people are required to support it. System 2000 can interface to its own teleprocessing monitor or to CICS with ease."

  - "We liked the capability of rapid inquiry in an on-line environment. The inverted list structure was also needed."

6. MINICOMPUTER BASED DBMS

- The four mini-based DBMS installations interviewed included two Microdata Reality Systems, ADMINS (developed by ADMINS, Inc. for the PDP/11), and a DPL installation. The main reasons for selection were the hardware:

  - The Microdata installations selected the computer first and then added Reality.

  - ADMINS was the only product available at the time which would run on a PDP-11.

  - DPL was selected because it was one of the only systems which would run on a DEC 10 or 20.

D. DBMS USER EXPENDITURES

- The initial purchase price of selected DBMSs ranged from $22,500 (TOTAL) to $112,000 (System 2000). The monthly lease price for DBMS ranged from $1,000 (IDMS) to $5,000 (IMS). Further detail on prices is contained in Section V of this study.

- The total investment to implement a DBMS ranged from $35,500 to $5 million. This includes purchase price (or lease commitment), training, and conversion costs.

- Ongoing annual expenditures ranged from $1,000 to $1 million with an average cost of $122,000 for 26 respondents.

- In addition to these explicit costs, training costs and associated salaries contributed to the total operating cost.

- Highest costs were experienced with IMS installations:

  - Several companies stated it took a year before programmers became proficient in the use of IMS.

  - Companies which were able to place a dollar value on training expenses estimated from $15,000 to $40,000 per IMS programmer.

- The number of personnel required to support the DBMS (other than applications programmers) was from 0 (some TOTAL installations) to 1-2 staff members for TOTAL, IDMS, ADABAS, and System 2000. IMS users required a minimum of 3 support personnel and two installations reported having a staff of 10-12.

- The cost of DBMS as seen by users is high and 70% thought their expenditures would increase.

- However, when asked if they had to do it over again, 96% stated they would still buy a DBMS and 86% would select the same one.

E. DBMS IMPACT ON HARDWARE UPGRADES

- Seventy-four percent (34 of 46 respondents) stated they had to upgrade their hardware since installing a DBMS. However, only 37% attributed the upgrade directly to the DBMS.

  - A number of companies stated the DBMS was not directly responsible, but did admit it was a contributing factor.

- Companies who experienced the largest increase in hardware upgrading were the IMS installations. Thirteen of the 18 IMS installations interviewed had upgraded. Six stated IMS was directly responsible. The other 7 stated it was a contributing factor or they upgraded in anticipation of IMS.

- Following is the upgrade history of 3 IMS installations:

  - Company #1: IMS was installed in 1974 and a 3 million byte 168 was installed at the same time. Since then they have upgraded their 168 to 5 million bytes and brought in a 3 million byte 158.

  - Company #2: IMS was installed in 1971 on a 360/40. The migration path since then went from a 155 and a 145, to two 155s, and now they have two 158 Mod IIIs.

  - Company #3: IMS was installed in 1976 when they had three 155s. They upgraded to a 168, a 158AP and a 155. In May 1978, they will have a 3033 and a 168.

    . Of additional interest, this company does not have any IMS applications operational. The first application is scheduled to be implemented shortly after the 3033 is installed.

F. PROGRAMMER SKILL LEVEL REQUIRED

- Contrary to some DBMS vendor claims of "ease of use" and "low level of programmer personnel required" to support their products, users are not finding this to be true.

- Most thought they needed more experienced programming personnel.

- In the case of IMS and System 2000, a much higher skill level was required. (See Exhibit IV-4.)

- The only products which received a low rating on required skill level were the minicomputer based DBMSs. The reasons are two-fold: they are considerably less complex (and less powerful) and are oriented toward non-programmer users.

- While most users experience the usual application development problems of planning and preparation of complete specifications, they did mention the following problems unique to DBMS:

  - Data definition.

  - Understanding the DBMS concept.

  - Education/training of programmers and users.

G. GROWTH IN DBMS USE

- Exhibit IV-5 shows the use of DBMS as a percentage of total applications. Current usage is relatively low:

EXHIBIT IV-4

PROGRAMMER SKILL LEVEL REQUIRED FOR DBMS
AS PERCEIVED BY RESPONDENTS

NAME OF DBMS	SKILL LEVEL		
	HIGH	MEDIUM	LOW
IDMS		●	
TOTAL		●	
ADABAS		●	
IMS	●		
SYSTEM 2000	●		
DATACOM/DB		●	
UNIVAC DMS		●	
MINI BASED DBMS			●

SKILL LEVELS:
HIGH = OVER 5 YEARS OF EXPERIENCE
MEDIUM = 2–5 YEARS OF EXPERIENCE
LOW = ENTRY LEVEL PROGRAMMER

EXHIBIT IV-5

DBMS USE AS A PERCENTAGE
OF TOTAL APPLICATIONS

DBMS NAME	NO. OF RESPONSES	% OF TOTAL APPLICATIONS							
		0	1–5	6–10	15–20	25–35	40–50	60–75	>75
IMS	17	3	3	2	1	4	2	2	
IDMS	8		1	3	1	2	1		
TOTAL	7		2	1	2	1		1	
ADABAS	5	2		3					
SYSTEM 2000	2	1		1					
DATACOM/DB	1			1					
UNIVAC DMS	1						1		
MINI BASED DBMS	4		1					2	1
IN-HOUSE DBMS	2						1		1
TOTAL	47	6	7	11	4	7	5	5	2

- Fifty-one percent of the users had less than 10% of their applications installed under DBMS.

- Seventy-five percent had less than 30% of their applications installed on a DBMS.

- The main factor for the low percentage is that most companies do not convert previously implemented applications and only use their DBMS for new application development.

- From the current low base, users anticipate solid growth in DBMS usage. Nine companies estimated an average growth in applications using DBMS from a current average of 22% using DBMS to a 1981 level of 64%. The variation in responses is shown in Exhibit IV-6.

H. DBMS USE BY APPLICATION

- The 10 applications most frequently cited as being the basis for DBMS use are tabulated in Exhibit IV-7. The applications tend to be "General Business" in that they are used in several industries, as compared to "Industry Specialty" which are used in a specific industry; e.g., Demand Deposit Accounting or point-of-sale.

- There is increasing interest in "Industry Specialty" applications. The following list categorizes applications by industry sector. All applications mentioned in the interviews are included in the list to provide a flavor of the mix of applications being implemented on DBMS.

DISCRETE MANUFACTURING

General Ledger
Order Entry
Inventory Control
Payroll
Work In Process
Customer Service System
Manufacturing Control Systems
Integrated Financial System
Engineering Control
Billing

PROCESS MANUFACTURING

Accounts Receivable
Market Information
Order Entry & Processing
Inventory Control
Financial
Accounts Payable/Receivable
Purchasing
Administrative Message Switching
Laboratory Data
Payroll
Benefits

TRANSPORTATION

Inventory and Production Control
Automated Pay Input System
General Ledger
Affirmative Action Monitoring
Shipment Tracking
Accounts Receivable
Accounts Payable

UTILITIES

Customer Information
Personnel
Construction Management

BANKING

Trust Savings (Inquiry)
Municipal Bonds
Demand Deposits
Trust Tax Accounting
Credit Card Accounting

DIVERSIFIED FINANCIAL

On-line Inquiry
On-line Claims
MIS
Order Entry
Accounts Receivable
Accounts Payable
Billing
Loan System
Cashiering Operations

INSURANCE

Project Administration
Medical Fees
Pension Administration
Stockholder Records
Group Insurance
Personnel

MEDICAL

Direct Mail
Patient Billing
Admission/Discharge/Transfer
Purchasing System
Clinical Data
Patient Data
Personnel

EDUCATION

Student Data Base
Employee Data Base
Financial System

RETAIL

Merchandising Processing
General Accounting
Personnel
Payroll
Inventory Control
Accounts Payable/Receivable

STATE/LOCAL GOVERNMENT

Tax (Refunds)
Parking Tickets
Financial Information
Master Property File
Personnel Information
Management Reporting
Employer Status
Employment History

COMPUTER SERVICES

Financial Modeling
Inventory Control
On-line Banking
General Ledger
Merchandising
Order Entry
Shipping
Sales Orders
Accounts Payable

MEDIA

Sales Inventory
Revenue Billing/Compensation
Audience Research
On-Line Order Entry

LEGAL

Police Information System
Offender Transaction File
Court System
Correction System
Jail Sentences

EXHIBIT IV-6

ANTICIPATED GROWTH IN DBMS USAGE
AMONG CURRENT DBMS USERS

PERCENTAGE OF TOTAL APPLICATIONS	
CURRENT DBMS USAGE	ANTICIPATED DBMS USAGE BY 1981
3%	40%
10	25
10	55
10	90
15	90
20	100
30	75
33	100
60	90

EXHIBIT IV-7

TEN APPLICATIONS MOST FREQUENTLY MENTIONED BY RESPONDENTS

APPLICATION	NO. OF MENTIONS
ACCOUNTING	26
INVENTORY CONTROL	11
PERSONNEL SYSTEMS	10
MANAGEMENT SYSTEMS	9
ORDER ENTRY	8
BANKING	8
MEDICAL	8
LEGAL SYSTEMS	6
PAYROLL	6
INSURANCE	5
TOTAL	97

I. DBMS USE BY INDUSTRY SECTOR

- To determine the relative penetration of DBMS by industry, a mail questionnaire was sent to 2,000 large EDP centers. Results developed from 183 responses are presented in Exhibit IV-8:

  - Discrete Manufacturing and Banking & Finance have the highest frequency of DBMS use.

  - Process Manufacturing is almost even: 50% with a DBMS and 50% without.

  - Insurance and Education have a lower percentage of DBMS installations.

  - The Transportation industry has the lowest percentage of installations.

J. DBMS USE BY MAINFRAME TYPE

- The same mail questionnaire referred to above was used to relate DBMS to mainframe type. It also provided a broader sampling than was obtained in the in-depth interviews. Results are presented in Exhibit IV-9.

  - Of the 183 companies surveyed, 92 had a DBMS. Some of the "DBMS" products listed, e.g., VSAM, DBOMP, and CICS are not considered true DBMS in this study. They are included in the listing because some users consider them to be DBMS and vendors approaching users to market DBMS can expect to encounter this viewpoint.

EXHIBIT IV-8
DBMS USE BY INDUSTRY SECTOR

INDUSTRY	NO. OF RESPONDENTS			% OF RESPONDENTS HAVING DBMS
	DBMS INSTALLED	NO. DBMS	TOTAL	
DISCRETE MANUFACTURING	23	13	36	64
PROCESS MANUFACTURING	16	14	30	53
TRANSPORTATION	1	5	6	16
UTILITIES	4	7	11	36
BANKING & FINANCE	10	6	16	62
INSURANCE	11	19	30	37
EDUCATION	10	15	25	40
RETAIL	3	5	8	37
WHOLESALE	4	4	8	50
SERVICES	4	4	8	50
OTHER INDUSTRIES	3	2	5	60
TOTALS	89	94	183	46

SOURCE: INPUTS EDP USER MAIL QUESTIONNAIRE

EXHIBIT IV-9

DBMS USE BY MAINFRAME TYPE ACCORDING TO RESPONDENTS

MAINFRAME	NUMBER OF MAINFRAMES	DBMS NAME	NUMBER OF MENTIONS	SATISFACTION LEVEL
IBM/360/40	1	DBOMP	1	3
360/50	9	TOTAL	2	1,2
360/65	5	IDMS	1	1
OTHER 360 SER.	11	-		
370/125	3	DBOMP	1	3
		INFOS	1	2
370/135	22	DBOMP	1	3
		IDMS	1	2
		IOSVS	1	1
		DL/I	1	4
		TOTAL	1	2
		IN-HOUSE	1	3
370/138	22	DBOMP	1	3
		DL/I	3	3,2
		DATACOM/DB	1	2
		TOTAL	1	2
		VSAM	1	3
370/145	48	IDMS	3	3,4,2
		TOTAL	3	1,1
		DL/I	3	5,2,3
		IMS	2	2,4
		CICS	1	
		DATACOM/DB	1	5
		IN-HOUSE	1	
370/148	27	DL/I	3	3,3,4
		DBOMP	2	2,2
		TOTAL	1	2
		ADABAS	1	2
		IMS	1	5
370/148		IDMS	1	1
		CICS	1	2
370/155	7	CICS	1	1
		IMS	2	2,2
370/158	29	IN-HOUSE	1	3
		DBS/RDAM	1	4
		IMS	7	3(2),3(3),4
		DL/I	1	2
		DB+DC	1	2
		TOTAL	1	2
		ADABAS	1	1
370/168	18	IMS	6	2,3(3),4
		DBS/DCS	1	3
		TOTAL	2	2,2
		IN-HOUSE	1	1
OTHER 370 SER	6	-		
OTHER IBM	3	-		
BURROUGHS				
4708	1	FORTE/2	1	4
6748	1	DMS-II	2	1,3
771	1	DMS	1	1
OTHER	7	-		
CDC				
ALL	7			
AMDAHL				
470-V6	1	INQUIRE	1	2
DEC				
1040	2	DBMS-10	1	4
10	23	DBMS-10	1	3
20	4	DBMS-11	1	3
11	8	UNIX	1	2
OTHER	5			
HONEYWELL				
6610	1	TOTAL	1	3

SATISFACTION LEVEL: 1=HIGHLY SATISFIED
5=DISSATISFIED

EXHIBIT IV-9 (CONT'D.)

DBMS USE BY MAINFRAME TYPE ACCORDING TO RESPONDENTS

MAINFRAME	NUMBER OF MAINFRAMES	DBMS NAME	NUMBER OF MENTIONS	SATISFACTION LEVEL
HONEYWELL				
6620	2	IDS	2	1,3
6640	3	DPAC	2	2,2
		IDS	1	2
6680	1	IDS	1	2
2050A	3	TOTAL	2	2,1
OTHER	14	-		
NCR				
300	1	TOTAL	1	2
OTHER	4			
UNIVAC				
1100/21	2	DMS	2	3,3
1110	1	DMS	1	3
90/60	1	-		
OTHER	8			
XEROX				
SIGMA-9	1	EDMS	1	3
H-P				
2000	2			
ITEL				
AS-5	2			
TOTAL RESPONDENTS	183		316	92

SATISFACTION LEVEL: 1=HIGHLY SATISFIED
5=DISSATISFIED

- Since users were asked only if they had a DBMS and were not asked to identify the specific mainframe(s) on which the DBMS was installed, an assumption was made:

  . In a multiple-mainframe site, the DBMS was assumed to be installed only on the largest mainframe.
  . Since many DBMS are installed on multiple mainframes, the total DBMS population is significantly understated. However, the mix of mainframes and DBMS shown is a useful indicator of the relative frequency of installation across a wide range of mainframes.

- A separate analysis of IBM installations showed that 44% of sites with medium-sized computers (360/40's - 370/148's) have a DBMS installed. Of the larger installations, 370/155 and above, 74% had a DBMS installed.

- TOTAL is mentioned almost as often (15) as IMS (18). "In-house" DBMS receives only 3 mentions, reflecting the high penetration of software packages.

- Of the 183 respondents, 42 stated that they have programs underway to evaluate DBMS. Of these, 37 had IBM mainframes.

- With regard to levels of user satisfaction, the results of the in-depth interviews are reinforced by the returns from the mail questionnaire. Exhibit IV-10 reflects the level of user satisfaction from respondents surveyed by mail.

  - IMS has the lowest level of user satisfaction among the major DBMS products.

EXHIBIT IV-10

USER SATISFACTION BY DBMS TYPE ACCORDING TO RESPONDENTS

NAME OF DBMS	NUMBER OF MENTIONS	SATISFACTION LEVEL
IMS	16	3.1
DL/1	10	3.1
TOTAL	13	1.8
IDMS	6	2.2
IDS	4	2.0
DMS/FORTE	4	2.6
DATACOM	3	3.0
DMS (UNIVAC)	3	3.0
ADABAS	2	1.5

SATISFACTION LEVEL: 1=HIGHLY SATISFIED
5=DISSATISFIED

SOURCE: INPUT'S MAIL QUESTIONNAIRE

- The satisfaction levels with the individual DBMS are consistent across mainframe sizes and types. This is consistent with the high importance users give to the performance characteristics of the software, independent of the hardware. User attitudes regarding specific software characteristics are discussed in Section VI of this report.

- Of the respondents, only three reported using a DBMS service from an RCS vendor:

  - One using NOMAD from NCSS reporting a high satisfaction level.

  - One each using IMS and Oliver (from On-Line Systems) reporting a medium satisfaction level.

- The low response rate on the use of DBMS services reflect that these services are often successfully marketed outside of the EDP Manager's span of control.

V COMPETITIVE ENVIRONMENT

V COMPETITIVE ENVIRONMENT

A. MARKET STRUCTURE AND INTERVIEW PROFILE

- The DBMS marketplace is made up of three types of competitors:

  - Large mainframe vendors such as:

    . IBM
    . Burroughs
    . CDC
    . Honeywell
    . Univac

  - Minicomputer vendors such as:

    . Digital Equipment Corporation
    . Hewlett- Packard

  - Independent suppliers such as:

    . Cincom
    . Computer Corporation of America
    . Cullinane
    . Infodata Systems, Inc.
    . Information Builders
    . Insyte Datacom Corporation
    . International Data Base Systems
    . MRI Systems
    . Mathematica

- National Information Systems
- Software AG
- Software House

- All of the above were interviewed with the exception of IBM and Univac who declined to participate. Estimates about the market for the products of these two companies are therefore INPUT estimates and identified as such.

- In the final analysis, INPUT did not include the products of Information Builders (FOCUS), Mathematica (RAMIS), and National Information Systems (DPL). Although they are used extensively as tools to develop data bases, they are considered implementation languages rather than DBMS, as discussed earlier in Section III.

- Remote Computing Services (RCS) vendors such as CSC, Tymshare and National CSS offer DBMS services and are analyzed in detail in INPUT's 1977 study of "Data Base Management Systems Services." For completeness, a brief treatment of these services (vs. software) offerings is included at the end of this section. Those wanting more information are referred to the earlier report.

B. VENDOR REVENUE FROM DBMS PRODUCTS

1. MARKET SIZE

- Identified DBMS vendor revenues of $80.95 million in 1977 are shown in Exhibit V-1:

  - These revenues are derived from over 6,000 installations.

  - Six percent of these revenues come from remote computing services vendors who offer the DBMS as a service.

EXHIBIT V-1

IDENTIFIED VENDOR REVENUES FROM DBMS
AND NUMBER OF PACKAGES INSTALLED

DBMS NAME	VENDOR	YEAR INTRODUCED	TOTAL NO. INSTALLED	1977 REVENUE		
				IN-HOUSE SALES	RCS	TOTAL
ADABAS	SOFTWARE AG	1971	275	$5.0M	<1%	$5.0M
DBMS-10	DIGITAL EQUIPMENT	1973	65	$1.25M (E)		$1.25M (E)
DBMS-20	DIGITAL EQUIPMENT	1976	30			
DMS-II	BURROUGHS	1976	40(E)	$ .7M(E)		$0.7M(E)
DMS 170	CONTROL DATA	1976	36	.4M(E)		$0.4M(E)
DMS 1100	UNIVAC	1971	150(E)	—*	—*	—*
DATACOM/DB	INSYTE DATACOM	1971	125	$1.2M	$.3M	$1.5M
IDMS	CULLINANE	1973	375	$9.9M	$.1M	$10.M
IDS	HONEYWELL	1963	700(E)	—*	—*	—*
IDS-II	HONEYWELL	1975	16	.1M		.1M
IMS	IBM	1968	1100(E)	$33.M(E)		$33.M(E)
IMAGE 3000	HEWLETT PACKARD	1974	1000	2.1M(E)		2.1M(E)
INQUIRE	INFODATA	1969	100	2.5M	.1M	$2.6M
MODEL 204	COMPUTER CORP. OF AMERICA	1971	30	$1.M(E)	<1%	$1.M(E)
SEED	INTERNATIONAL DATA BASE SYSTEMS	1977	12	$ .3(E)		$ .3(E)
SYSTEM 1022	SOFTWARE HOUSE	1973	40	$ .8(E)	1.2M(E)	$2.0M(E)
SYSTEM 2000	MRI SYSTEMS	1972	260	$4.8	1.2M	$6.0M
TOTAL	CINCOM	1969	>2,000	$12.5(E)	2.5(E)	$15.M
TOTALS			6,304	$75.55	$5.4	$80.95

*PROVIDED WITHOUT CHARGE TO HARDWARE INSTALLATIONS
(E) = INPUT ESTIMATE

- The total DBMS market was presented in detail in Sections II and III of this study. The revenues in Exhibit V-1 constitute an estimated 90% of the total current software market.

2. MARKET SHARE BY VENDOR

- Exhibit V-2 provides market shares of the identifed marketplace by both dollar revenue share and number of installations.

- The four leading revenue producers in terms of market share in 1977 were:

-	IBM	41%
-	Cincom	18%
-	Cullinane	12%
-	MRI Systems	7%
	TOTAL	78%

- IBM's share of the mainframe market is significantly higher than its share of the DBMS market, reflecting the success of other IBM compatible software on the market.

- Cincom has 18% of the revenue but over 32% of the installations.

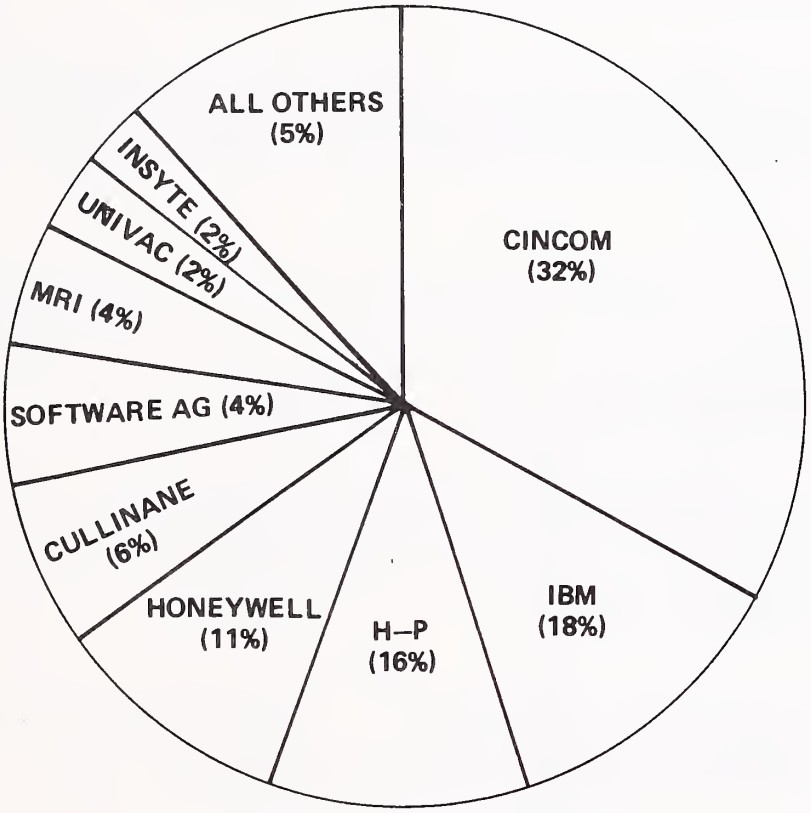
- MRI (among the leading vendors) had the closest balance with 7% of its revenue dervied from 4% of the installations.

- Hewlett-Packard has only 2.5% of the revenue as compared with 16% of the installations. (Hewlett-Packard's DBMS is priced as only a $3,000 addition to its hardware sales price; therefore, a relatively painless cost addition to the user.)

- With regard to future market share, much depends on IBM product offerings.

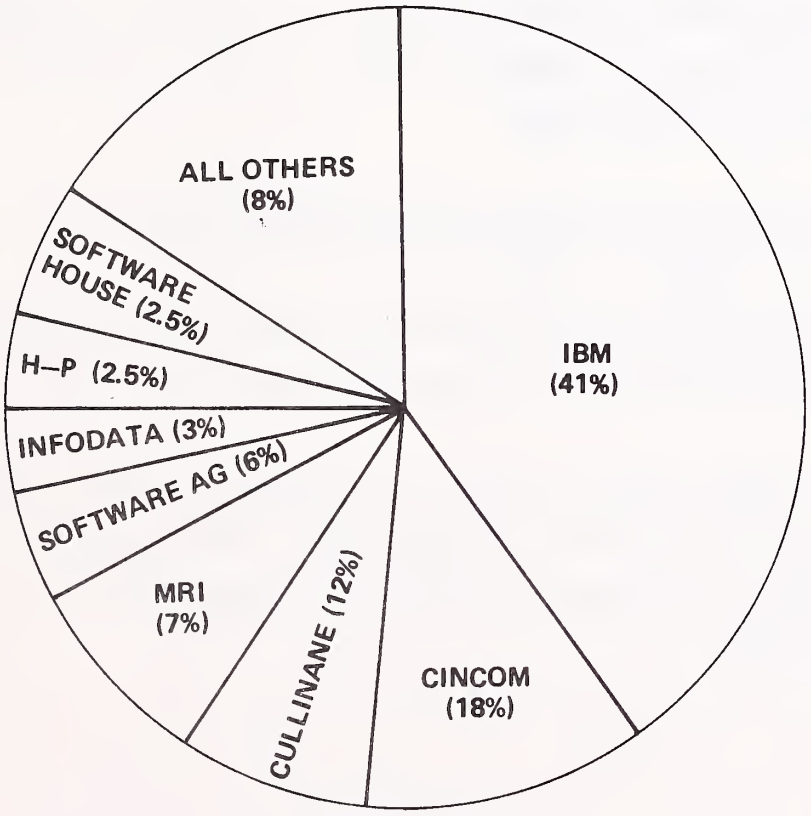
EXHIBIT V-2

VENDORS' SHARE OF THE IDENTIFIED DBMS MARKET



NUMBER OF INSTALLATIONS

TOTAL NO. OF INSTALLATIONS 6304



REVENUE SHARE

TOTAL REVENUES

SOFTWARE	$75.55 mil
RCS	5.4
TOTAL	$80.95 mil

- ADABAS and IDMS are gaining significantly in the marketplace of current IBM products and have started replacing some IMS installations.

  - Software AG reported at least 20 sales in 1977 to IMS installations and replacements or additions of ADABAS are currently running at 2 per month.

  - Fifty percent of the companies keep IMS even after installing ADABAS. Conversion costs are the inhibiting factor when total replacement of IMS is considered.

  - Software AG reported 75% of these firms converting to ADABAS are long-time IMS users (5-7 years). The other 25% are companies who have had IMS installed 1-2 years.

  - Cullinane also reported receiving new sales from IMS users. IDMS is currently replacing or being added to 6-12 IMS sites a year.

- On balance, vendors do not expect any significant redivision of DBMS revenues among their competitors over the next 5 years. INPUT concurs that market shares will remain essentially stable.

- Vendors were asked about the timing on the sale of their products:

  - The results of the 63% who responded to this question was that 29% of all packages sold was accomplished in a single year - 1977.

  - Vendors' product sales in 1977, as a percent of total packages sold, ranged from good (18%) to dramatic (50%). These figures further verify that DBMS is experiencing a high rate of growth. Details are presented in Exhibit V-3.

EXHIBIT V-3

COMPARISON OF TOTAL DBMS PACKAGE SALES WITH 1977 SALES

DBMS PACKAGE	TOTAL PKG. SOLD	1977 PKG SOLD	% SOLD IN 1977
SYSTEM 1022	40	20	50%
IMAGE 3000	1000	400	40%
DATACOM/DB	125	50	40%
ADABAS	275	100	36%
SYSTEM 2000	260	70	27%
IDMS	375	100	27%
TOTAL	>2000	500	25%
MODEL 204	30	6	20%
INQUIRE	100	18	18%
TOTAL	4395	1289	29%

C. VENDORS' ESTIMATE OF PRODUCT GROWTH, 1978-1983

- Of the 15 DBMS vendors interviewed, there was considerable variability in market growth forecasts. A composite forecast appears in Exhibit V-4:

  - Nine of the vendors estimated growth for 1978 that ranged from 15 to 300%.

    . Highest growth in sales was from SEED, a new and very inexpensive DBMS product.

  - Only 40% (6) of the vendors would estimate revenue figures for the 1980 period, and these ranged from 35 to 500%. (SEED again being the high estimate).

  - Only 4 firms (27%) would estimate 1983 growth. These estimates ranged from 35 to 50%. Applying these estimates on a proportional basis related to market share of these firms, resulted in a 1983 forecast of $337 million compared to the 1977 revenues of $80.95 derived on Exhibit V-1.

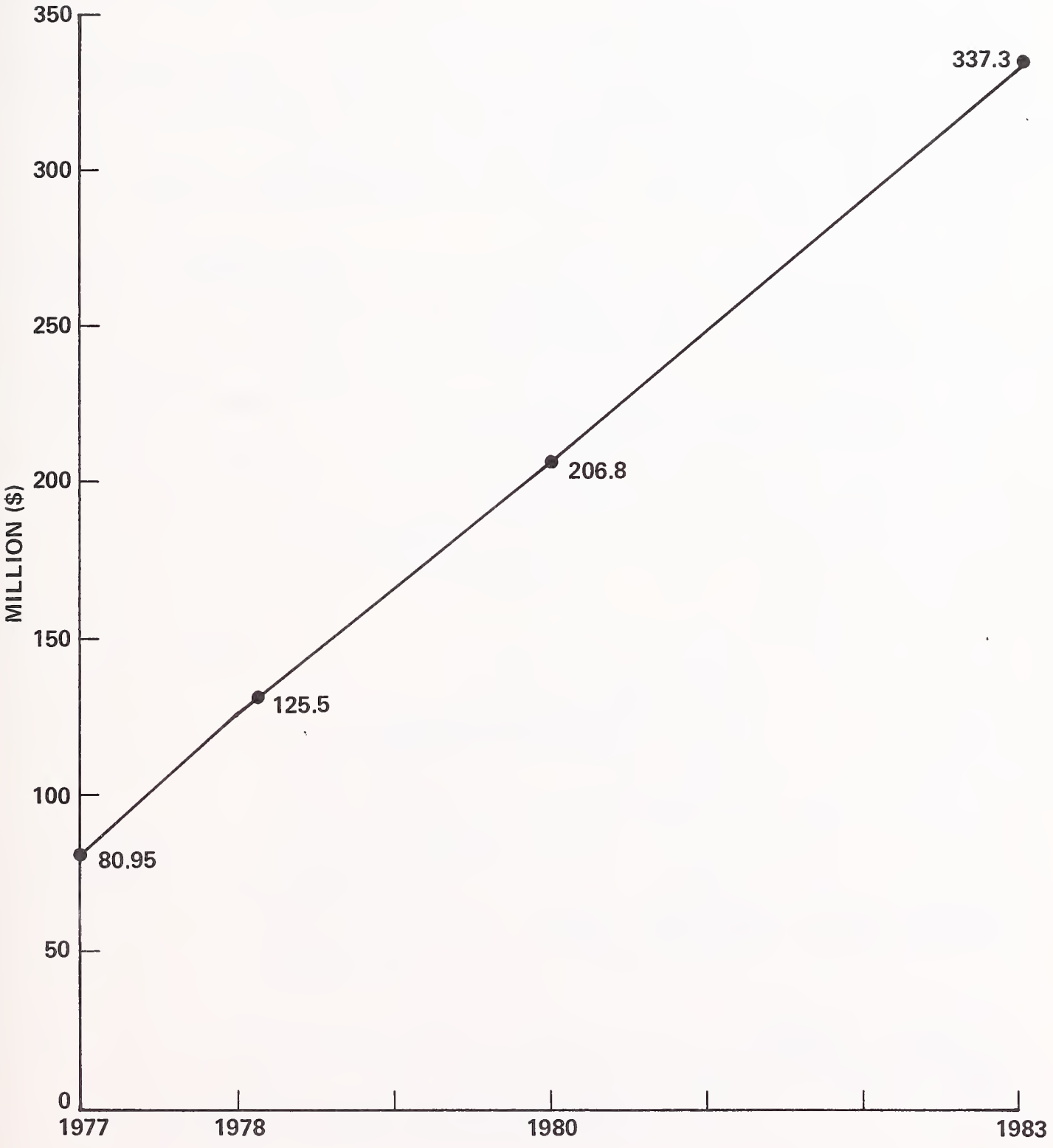
  - The vendor estimate is lower than INPUT's estimate of the total market among large and medium-sized systems presented earlier in Section III. A major reason for the difference is that INPUT's forecast includes an accelerated participation in DBMS revenues by mainframe vendors.

- The emerging market for DBMS for minicomputers is not included in the above forecasts.

- Some mainframe DBMS suppliers forecasted their revenue growth from DBMS products to be in direct proportion to hardware sales.

EXHIBIT V-4

COMPOSITE VENDOR DBMS SALES FORECAST
FOR MEDIUM AND LARGE SCALE SYSTEMS



D. DBMS PRODUCT ENHANCEMENTS BY VENDORS

- Almost all vendors interviewed had new product enhancements in progress or planned.

- Only one vendor (Hewlett-Packard) stated that its product (IMAGE) is and would remain in a "maintenance mode."

- Most planned changes were in the enhancement of existing products.

- One clear trend is the orientation of DBMS product development to the end user by adding on-line query languages and on-line editors.

- Incorporation of a data dictionary is becoming increasingly important and is generally implemented because of user demands.

- Some of the specific enhancements by product are:

  - IDMS:

    . Multi-threading capability.
    . On-line editor within DC portion.
    . Enhancements to on-line Query II.
    . Adding an on-line update.
    . Two new versions of CULPRIT.
    . Program maintenance with a data dictionary (source library system).
    . On-line Query II.

  - IDS:

    . FORTRAN IDS-II interface.

- DMS 170:

  . FORTRAN interface.
  . Data dictionary.
  . Improvements in data independence and security.

- ADABAS:

  . ADACOM query language to replace ADASCRIPT and ADAWRITER.

- DBMS 10/20:

  . Data manipulation language and a data dictionary are under consideration.

- Model 204:

  . Data dictionary.
  . Data definition language.

- SEED:

  . Pointer array data structure.
  . Report writer.
  . Query language.
  . Simultaneous update.
  . COBOL interface.
  . Data manipulation language with some data dictionary capabilities.

- It is significant that the above changes reveal no revolutionary changes in DBMS technology. Several vendors stated any new breakthroughs in DBMS would only come through changes in hardware.

- Most vendors did indicate a continuing R&D program that was directed toward incorporating enhancements. These investments ranged from $100,000 to $1 million a year.

E. DBMS HARDWARE COMPATIBILITY

- Exhibit V-5 provides a matrix comparison of DBMS products versus hardware compatibility.

- As expected, 53% (9 of 17 products) run on IBM or IBM compatible hardware.

- Four IBM compatible products (TOTAL, IDMS, SYSTEM 2000, ADABAS) represented 44% of 1977 DBMS sales.

- TOTAL offers the highest degree of machine portability. It is capable of operating on 70% of the hardware listed.

- SEED offers similar machine portability (it can run on any system which supports FORTRAN). It is a newer product and has not been installed on as many systems as TOTAL.

F. USER SELECTION CRITERIA AS VIEWED BY VENDORS

- As part of the interview process, vendors were asked to rank in order of importance certain criteria used by their customers during the selection process. The resultant ranking was consistent among most vendors:

  1. DBMS features
  2. Vendor product reliability

EXHIBIT V-5

DBMS HARDWARE COMPARISON

NAME OF DBMS	BURROUGHS	CDC	DEC 10 & 20	DEC DDPII	HARRIS	HEWLETT-PACKARD	HONEYWELL	IBM 360/370	IBM COMPATIBLES	IBM SERIES/1	IBM SYSTEM/3	INTERDATA	MODCOMP	NCR	SIEMANS	UNIVAC	VARIAN	XITAN 280
ADABAS								●	●						●			
DBMS 10			●															
DMS II	●																	
DMS 1100																●		
DATACOM D/B								●	●									
IDMS								●	●									
IDS							●											
IMS								●	●									
IMAGE 3000						●												
INQUIRE								●	●									
MODEL 204								●	●									
SEED	●	●	●	●			●	●	●	●		●	●			●		
MICROSEED																		●
SYSTEM 1022			●															
SYSTEM 2000		●						●	●							●		
TOTAL	●	●		●	●		●	●	●		●	●	●	●		●	●	

3. Vendor experience with customer application
4. Vendor price
5. Vendor technical support

- As reported in the previous section, users placed more emphasis on ease of use and overall performance which translates into features they are looking for in a DBMS.

- This ranking question also elicited some comments from the vendors that indicated a change in the user community during the last several years. Prior questions by users about DBMS products were general in nature. (Does it meet the CODASYL standard? Is it hierarchical?) Vendors now indicate a higher level of user knowledge and users are asking more questions on the operational and technical aspects.

- The DBMS marketplace does not appear to be particularly price sensitive with price being ranked 4th of 5 criteria. This is significant in view of the wide range of prices available as is shown in the following section. Obviously, performance is more important than price.

G. PRICE COMPARISON OF DBMS PRODUCTS

1. BASE PRICES AND TOTAL PRICE

- Exhibit V-6 provides a compilation of the DBMS products surveyed. This exhibit has two pricing components: the range of prices from the base price to a price including all options, and the average purchase price of those sold. The Exhibit also provides annual maintenance costs:

EXHIBIT V-6

PRICING OF DBMS PRODUCTS

NAME OF DBMS	PURCHASE PRICE INCLUDING OPTIONS	MONTHLY LEASE INCLUDING OPTIONS	AVERAGE PRICE		% OF PACKAGES		MAINTENANCE	
			PURCHASE*	MO. LEASE	PURCHASED*	LEASED	ANNUAL FEE	% OF PURCHASE
ADABAS	$132,000	$1,667 – 5,000	$105,000	$3,000	50%	50%	$6,600	
DBMS 10	$27,500 – 42,500		42,500		100			10%
DMS-II	26,980 – 37,130	900 – 1,239						10%
DMS 170	25,000 – 42,040	630 – 1,050	40,000	900	20	80	5,460–9,180	
DATACOM/DB	34,000 – 83,900	1,000 – 2,790	45,000	1,100	50	50		9%
IDMS	45,000 – 112,000	1,500 – 4,000	98,000	3,000	85	15		10%
I-D-S/II		998		998		100		
IMS		646 – 4,400		2,500		100		
IMAGE 3000	$3,000				100		1,500	
INQUIRE	65,000 – 130,000	1,450 – 4,500	98,000	3,000	85	15	6,000–8,400	
MODEL 204	60,000 – 115,000	2,750 – 4,400	90,000	3,400	25	75		9%
SEED	8,750 – 16,000	425 – 700	11,000	600	100		1,500	
SYSTEM 1022	30,000 – 40,000	1,000 – 1,400	35,000	1,200	90	10	2,400	
SYSTEM 2000	60,000 – 142,000	2,000 – 5,800	70,000	3,000	60	40	3,000–10,000	
TOTAL	15,000 – 50,000	825 – 1,150	35,000	990	35	65		8%

*INCLUDES PAID-UP LICENSE AGREEMENTS

- The purchase prices of DBMS packages range from $8,750 (SEED) to $137,000 (System 2000). No attempts were made to derive an average price for all the products since the products vary widely with regard to capability.

- Monthly leases range from $425 (SEED) to $5,000 (ADABAS).

2. PURCHASE, LEASE, MAINTENANCE COMPARISONS

- There is no consistent pattern among the packages in terms of percentage of packages that are leased as compared to packages that are purchased.

- Some vendors bill maintenance as a percentage of purchase price while others charge a fixed rate per year. If the percentages are converted to fixed rates there is no significant difference between the two pricing strategies.

- Since DBMS products represent a heterogeneous mix of capability designed to meet a variety of uses, prices have not been compared to capability within the scope of this study. In some cases, the DBMS is used as an adjunct to the sale of hardware, further complicating the comparison of price and capability. The more meaningful differences between DBMS products are those covered in the study; e.g., user attitudes, market shares, planned enhancements.

H. THE ISSUE OF STANDARDIZATION

- There was general consensus among the vendors that there would not be an industry standard on data models in the foreseeable future.

  - As one vendor stated, "It's like standardizing on a 27 propeller airplane rather than a jet engine."

- The acceptance of CODASYL as the standard seems to be losing its appeal. Vendors generally agreed that if CODASYL modified by ANSI/SPARC is not accepted as a standard, nothing else will be. Such acceptance is now viewed as unlikely.

- Several of the vendors felt that standardization on a DBMS data model would have a negative impact:

  - It would stiffle R&D efforts on the development of relational models.

  - It would limit users to accepting one technique even though it was not the most suitable for their particular application.

- Vendors generally agreed there was a trend in the industry towards relational data structures; however, they did not expect to see a true implementation of a relational data system for some time - at least not for large scale commercial processing.

  - A few vendors were skeptical whether a successful one could even be built because of difficulties in handling large data bases.

I. RECENT DEVELOPMENTS IN DBMS

- Two new announcements of DBMS products/technology are particularly interesting:

  - MICROSEED, a DBMS now available on a XITAN 280 microcomputer.

  - Cullinane placing IDMS on a back-end computer (DEC PDP/11).

- MICROSEED, a subset of International Data Base System's SEED, is the first commercially available DBMS on a microcomputer:

  - Announced in January 1978, MICROSEED has already been installed at 20 sites.

  - Although MICROSEED is roughly the equivalent of SEED Kernel (the main DBMS module) it does have limitations. It is not capable of handling on-line interactive functions and only offers very rudimentary DBMS capabilities.

  - Simple data base functions of building files and retrieving records can be handled, however.

  - The long range plan of IDBS is to use MICROSEED in a distributed data base environment on a network of microcomputers.

- Cullinane, under contract with the Department of Army, developed an experimental system of IDMS on a PDP/11 to be used as a back-end data base processor. Cullinane is planning further development in this area. They have labeled the product their "Multiple Computer" support capability.

  - The advantages foreseen by Cullinane is the ability to get at a common data base from different CPUs. Security and integrity of the data are also improved because a common data base can be updated without going through one mainframe.

  - The disadvantage was worse performance.

  - Cullinane frankly admitted that "back-end data base computers would not be successful until IBM pushed the idea." In spite of this obstacle, several other data base/hardware developments are known to be underway in the industry.

J. KEY VENDOR PROFILES

1. CINCOM SYSTEMS, INC.

- Cincom's TOTAL is the most widely used DBMS package on the market today. It was introduced in 1970.

- Worldwide sales of TOTAL in 1977 were 500 systems, 50% of which were sold outside the U.S.

- TOTAL is available on more hardware mainframes than any other DBMS package. More installations on minicomputers are targeted for future releases.

2. COMPUTER CORPORATION OF AMERICA

- CCA announced Model 204 in 1971 and has it installed at 30 sites.

- One of the reasons for its relatively low sales is the lack of attention CCA has given to marketing. For years they relied on users to buy the product simply because it was good. Now they intend to put more money into advertising and marketing. CCA plans to establish an active marketing program this year.

- Model 204 has an inverted file structure which will logically support hierarchical, network or pseudo-relational structures. CCA emphasizes its ease of use by non-programming personnel coupled with its ability to handle complex applications.

- The majority of Model 204 sales have been to the Federal Government.

- CCA's biggest competitor is Software AG's ADABAS. Other competitors are DATACOM, INQUIRE and SYSTEM 2000.

- Remote Computing Services (RCS) relationships have been established with Informatics and American Management Systems.

3. CONTROL DATA CORPORATION

- CDC's DBMS runs on their 6000, CYBER 70, and CYBER 170 Series. Although only 36 DMS 170s have been installed, CDC has achieved a 15% penetration of its installations who are commercial processing users. (There are approximately 500 CDC 6000 and CYBER 70 and 170 installations; 50% of these are used for scientific processing.)

  - The majority of their DBMS installations are in manufacturing and education.

- CDC's image as a "number cruncher" computer manufacturer is an inhibiting factor in selling to the commercial DBMS marketplace.

- CDC has looked at back-end data base computers and believes it can be done today with existing hardware and software. They have not identified a user demand for the product.

- CDC also has an experimental DBMS project called EDMS. Developed by Dr. Nijssen in Belgium, EDMS follows the CODASYL '77 and ANSI/SPARC recommendations and has a relational query language.

- EDMS is not expected to be released as a product for several years, if ever. CDC currently has EDMS installed at 10-15 customer sites; however, it does not currently support it.

4. CULLINANE

- Cullinane is the second largest independent DBMS vendor in sales volume and number of packages sold. Sales of IDMS have grown to 375 installations since 1973.

- IDMS was acquired by John Cullinane from B. F. Goodrich after they had converted G.E.'s IDS to IBM hardware.

- A key marketing advantage of IDMS is that it is the only IBM compatible product which has the CODASYL standard.

- A version of IDMS is also being marketed by Digital Equipment Corporation on its PDP/11 series. Called DBMS/11, 15 systems have been sold to date at a purchase price of $16,500.

- Cullinane has RCS relationships with:

  - Boeing Computer Services
  - System Development Laboratory
  - Data Crown
  - Computer Usage Corporation

5. DIGITAL EQUIPMENT CORPORATION

- DEC's DBMS for the System 10 (DBMS 10) was originally developed by Rapidata and first implemented on its hardware in 1973. Since then it has been installed on the DEC 20 System (DBMS 20).

- Their current installed base:

Hardware Installed		DBMS Installed
DEC 10	600+	65
DEC 20	200+	35

- Although DEC is the largest manufacturer of minicomputers (15,000-20,000 units shipped a year) its penetration in the DBMS area has been negligible.

- Other vendors were particularly conscious of DEC's offering and volunteered the following types of comments:

  - Standard CODASYL implementation is an advantage.

  - DEC addresses itself to the more sophisticated user where everything is centrally controlled, not to the less sophisticated user.

  - Purging can be a serious problem.

- DEC markets its product to all industry sectors. However, education receives some emphasis, and 30% of its hardware is installed in educational institutions.

8. HEWLETT-PACKARD

- Hewlett-Packard first introduced the 3000 Series in 1971. Current shipments of the 3000 Series are running 100 units a month, of which 75% have IMAGE 3000 installed.

- Although IMAGE 3000 was not introduced until early 1974, it appears to be well accepted in the marketplace. There are approximately 1000 IMAGE 3000 installations.

- There are no estimates as to how extensively IMAGE is being used and since it costs only $3,000 plus maintenance contract of $4,500 ($125 per month for 48 months), it would not have to be used extensively to justify its purchase.

- IMAGE is also available on the HP-1000. Although the Hewlett-Packard 1000 is primarily a scientific machine, 25% of these are shipped with IMAGE.

- Both versions of IMAGE provide interfaces to RPG, COBOL, BASIC, FORTRAN or SPL (HP's high-level assembler language).

- The market Hewlett-Packard considers for stand alone system sales are companies in the $10-100 million range. Companies above the $100 million range are considered as possible sites for "satellite" sales.

- Although Hewlett-Packard does not concentrate its marketing efforts in any one industry sector, a number of their installations are in educational institutions, especially small schools and junior colleges. Hewlett-Packard is also gaining in sales to manufacturers.

- One of the major features of IMAGE 3000 is a communications capability between systems. Interfaces are also being developed to communicate with IMAGE 1000 systems. Hewlett Packard can be a serious contendor in the distributed processing marketplace with this DBMS capability.

- As stated earlier, IMAGE is currently in a maintenance mode. HP implied that both a relational system and a backend computer were under consideration.

- And, as one spokesman from HP stated: "We see desktop computers, minis, and superminis merging. There is a need to get DP out to the people who are familiar with the problem. Users are looking for an applications engine. We'd like to be the vendor to supply them with one."

9. HONEYWELL

- IDS is the grandfather of all DBMS systems. Designed by Charles Bachman and first announced in 1963, its basic concept and design can be seen in every CODASYL DBMS product on the market today.

- Cullinane's IDMS, Univac's DMS 90 and Xerox's EDS are all versions of IDS.

- IDS-II was announced in 1975 and is a full implementation of CODASYL 71 specifications. It supports network or indexed file structures and in future releases IDS-II will support relational file structures.

- IDS has always been bundled with the hardware. With the announcement of IDS-II, Honeywell unbundled the software and is leasing it for $998 a month.

- In mid-1977, HIS installed DM4 on 4 to 5 test sites. DM4 is an integrated version of IDS-II with two new features: a transaction processor and a query and report generation capability.

- DM4 is priced at $2,500 a month and consists of the following: Data Base Manager, Transaction Processor, COBOL '74, Query Language and Report Generator, and a Procedural Language Processor which is offered as an alternative to COBOL '74.

- IDS-IIand DM 4 are offered on the 6000 and 66 Series but are not available under MULTICS.

- HIS is currently implementing a subset of DM4 on its Level 6 minicomputer to compete in the distributed processing market. HIS expects to start marketing this product in the Summer of 1978.

- Honeywell is very supportive of industry standards. Any future product announcements are assured to fall in line with CODASYL recommendations.

- As far as competitors are concerned, one spokesman from Honeywell stated: "We are all sisters in the war against IMS!"

6. INFODATA

- INQUIRE was first announced in 1969 as an information retrieval system. During the period of 1974-1976, DBMS capabilities were added.

- Versions and prices of INQUIRE being marketed are:
  - DBMS Version $ 98,000
  - INQUIRE Text $130,000
  - INQUIRE Basic $ 65,000

- Marketing efforts are concentrated on the Fortune 1000 firms and some concentration has been achieved in litigation support, pharmaceutical companies, and the banking industry.

- The appeal of INQUIRE to user organizations is its high level user language.

- INQUIRE is available on the following RCS services:

  - Boeing Computer Services.

  - Computer Network Corporation.

  - American Management Systems.

  - IST (Canada).

7. INSYTE DATACOM CORPORATION

- DATACOM/DB was first announced in 1971 and 125 systems have been installed.

- A comparison product DATACOM/DC is a data communications monitor. When sold with DATACOM/DB it is marketed under the name of DATACOM.

- A key marketing advantage for Insyte is that DATACOM/DB and DATACOM/DC were designed and developed by the same staff, specifically to work together.

10. INTERNATIONAL DATA BASE SYSTEMS, INC.

- IDBS is a unique new entry in the DBMS market. It has the only product on the market for under $10,000 (SEED) and the only DBMS on a microcomputer (MICROSEED) at the time this research was done.

- SEED is an outgrowth of Project Wand at the University of Pennsylvania.

- SEED is primarily written in FORTRAN and thus very portable. It supports hierarchical and network data structures, providing both schema and subschema views. CODASYL DDL, as well as FORTRAN and COBOL DML are fully implemented. The system also features an interactive data base/data dictionary interface.

- The portability of SEED can be seen by looking at the equipment it has been installed on:

System	No. of Installations
- DEC 10	6
- CDC 6400	1
- CDC Cyber 172	1
- IBM 370	2
- MODCOMP	1
- DEC PDP/11	1
- IBM Series/1	Currently being installed

- MICROSEED was announced in January 1978 and is available on a XITAN Z80 microcomputer. With a sales price of $1,250, its market potential is high.

- The major problems for IDBS is marketing:

  - IDBS is a new company with only 4 full-time employees.

  - Users still question the long-term availability of maintenance.

- No active marketing program has been established. Most sales have been "word-of-mouth."

- Most sales have been to research institutions and universities.

- Future marketing efforts will be aimed at the PDP/11 and Series/1 installations.

11. MRI SYSTEMS CORPORATION

- MRI's SYSTEM 2000 offers a full range of data management capabilities including a teleprocessing monitor (TP 2000), a data dictionary (CONTROL 2000), and interfaces to COBOL, FORTRAN, Assembler and PL/1 languages, as well as its own user-oriented, self-contained language.

- MRI's query language is considered by other vendors to be one of the best in the industry.

- SYSTEM 2000 is operational on IBM's 360/370 series, Univac's 1100 series under EXEC 8, and CDC's 6000, CYBER 70 and 170 series. TP 2000 is only available for IBM installations.

- Licensing arrangements of SYSTEM 2000 are currently with 23 service bureaus, 18 of which are headquartered in the U.S. and Canada, and 5 in Europe.

- Revenues from RCS vendors account for 20% of MRI's total revenues from SYSTEM 2000. (There are well over 300 users of SYSTEM 2000 on RCS networks.)

- MRI has been particularly successful in marketing to the Federal Government, with SYSTEM 2000 being pushed as a standard, e.g., the Department of Energy.

12. SOFTWARE AG

- Software AG's DBMS package, ADABAS, is one of the most successful products on the market. With a current installed base of 275 sites, Software AG is predicting a 40-50% growth rate per year for the next 5 years.

- Educating the user was the initial problem Software AG faced when it first started marketing ADABAS. Now the problem is to compete effectively with IBM.

- Software AG has done well in selling ADABAS to the insurance industry, publishers and state government. Sales to manufacturers had been slow until it announced ADABOMP to compete with IBM's DBOMP.

- Software AG is currently investing $1 million a year on R&D and states that 60% of requests received from the ADABAS Users Group are implemented.

- ADACOM, a new query language to be released in May or June 1978, will replace ADASCRIPT PLUS and ADAWRITER.

- ADABAS is available on two RCS services - Planning Research Corporation and Computel. Revenues received are less than 1% their total.

13. SOFTWARE HOUSE

- System 1022 was introduced in 1973. Sales of its product have been slow - only 40 have been installed to date.

- Designed for use on DEC System 10 and DEC System 20 computers, System 1022 has been used for applications in such areas as inventory control, personnel management, market research, correspondence systems, and hospital client information.

- Over 60% of Software Houses' revenues come from RCS services.

- System 1022 is available on Tymshare, Compuserv, ADP, First Data, Dataline Systems, and AMS networks.

K. RECENT DBMS ANNOUNCEMENTS OF RCS VENDORS

- During the preparation of this study, three RCS vendors introduced new products. Two are significant combinations of DBMS and on-site hardware. The third is a new DBMS service. A brief description of each is included.

1. AUTOMATIC DATA PROCESSING

- ADP is offering a totally bundled service (called ON-SITE) with mini hardware (the new DEC 2020) on-site at the customer's facility. The DEC 2020 will be linked to ADP's VAN network service via a microcommunications processor to permit full access to ADP RCS services.

- As in NCSS's RCS offering, users will have access to the full range of systems software including IPL, ADP's DBMS.

- The ON-SITE offering has the advantage of remote diagnostics being run nightly from Ann Arbor; ADP is advertising 99.5% or better up time.

2. NATIONAL CSS

- NCSS has announced a family of minis (NCSS 3200) for on-site use of its customers. It will be offered as a cost effective alternative to large IBM installations which are doing in-house timesharing. NOMAD, NCSS's DBMS is part of the offering.

- The Series 3200 will permit the customer to off-load its large mainframe and take over some outside timesharing.

- NCSS will offer Series 3200 either for purchase or on a full payment (third party) lease. The basic system in the family will sell for $185,000 with the software and the most extended system for $800,000.

- NCSS believes it will sell the Series 3200 in new application areas, either utilizing a network host or in communication with other minis through the NCSS packet switching network.

- NCSS believes that its DBMS (NOMAD) with its relational capability gives it a leading advantage in distributed data base applications.

- Exhibit V-7 provides a summary comparison of these two offerings.

3. COMPUTER SCIENCES CORPORATION

- CSC announced MANAGE in November 1977 which will be used on INFONET in conjunction with its ALADIN data base management system or as a standalone product.

- MANAGE can handle extended tree structures at multiple levels in addition to hierarchical, network and relational relationships.

EXHIBIT V-7

COMPARISON OF ADP AND NCSS HARDWARE OFFERINGS

FUNCTION	ADP	NCSS
SYSTEM		
• MINI	DEC 2020	SYSTEM 3200
• WORD SIZE	32 BIT	32 BIT
• MEMORY (MAX. SIZE)	2.5M BYTES	2M BYTES
• DISC (MAX. SIZE)	1.5M BYTES	2B BYTES
• STANDALONE	NO	YES
• HOST SYS. NETWORKING	YES	YES
• VAN NETWORKING (PACKET SWITCHING)	YES	YES
• SALE	NO	YES
• LEASE	YES	YES
• BUNDLED SERVICE	YES	NO
• TERMINALS	16-32	1-32
• LINE PRINTER	300-600/PM	300-1,000/PM
• ENVIRONMENT	OFFICE	OFFICE
• COST (RANGE)	$10,000-16,000/MO. (24-36 MONTH LEASE)	$185,000-$800,000 (PURCHASE)
• MAINTAIN	YES	YES
• DOWN LINE PROGRAM LOADING	YES	NOT YET ANNOUNCED
• REMOTE FAULT DIAGNOSIS	YES	NOT YET ANNOUNCED
• MAINT. MICROPROCESSOR	YES	NOT YET ANNOUNCED
• MULTI-LEVEL DATA SECURITY	YES	YES
• MONITORING SERVICE USAGE	YES	NOT YET ANNOUNCED

EXHIBIT V-7 (CONT'D.)

COMPARISON OF ADP AND NCSS HARDWARE OFFERINGS

FUNCTION	ADP	NCSS
SOFTWARE		
• OPERATING SYSTEM	DEC	VPS
• COBOL	YES	YES
• FORTRAN	YES	YES
• PL/1	YES	YES
• DATA BASE (1)	IPL	NOMAD
• FINANCIAL (1)	TSAM, FML	ESL
• PROJECT MGMT.(1)	APECS	YES
• GRAPHICS (1)	YES	YES
• TEXT PROCESSING (1)	YES	YES

(1) ADDITIONAL COST

- MANAGE can retrieve and consolidate information from up to 63 ALADIN data bases.

- MANAGE consists of four functional user interfaces: data base definition language (CODASYL-like), a natural procedural language, a query facility and a FORTRAN, COBOL or assembler interface.

- CSC reported there are already over 100 users of MANAGE.

VI PRODUCT AND MARKETING ISSUES

VI PRODUCT AND MARKETING ISSUES

A. IMPACT OF TECHNOLOGY ON DBMS

- While development of DBMS has been largely an evolutionary, rather than revolutionary process, current non-software developments are having a significant impact on DBMS growth and will accelerate the rate of change.

  - Microcomputer technology is making available lower cost and smaller unit increments of intelligence and memory.

  - Emerging lower cost communications from Value Added Networks (VANS) and satellite communications is making the distribution of data bases more economically feasible.

  - The increasing use of electronic word processing is creating vast amounts of text in digital format. This in turn increases user interest in text/graphics data bases for storage, manipulation, and retrieval.

  - The above factors combine with the emerging trend to distributed data processing (DDP). INPUT defines DDP as requiring two elements - remote programmability and an electronic communications link.

- In this section, product and marketing strategies for DBMS which capitalize on these developments are presented.

B. PRODUCT STRATEGIES FOR TECHNOLOGY ISSUES

1. MINICOMPUTER USE OF DBMS

- Central EDP management interviewed during this study had little control or knowledge of minicomputers installed outside of their own EDP organizations. Of seventy respondents to questions regarding use of minicomputers:

  - 80% stated no installed minis were making significant use of DBMS at the present time.

  - 70% felt use of DBMS on minis would be attractive, particularly to "non-EDP" end users.

- Interviewees who did not have a DBMS installed were more enthusiastic than current DBMS users about the prospect of mini-DBMS. Seventy-six percent were interested in mini-DBMS and 79% felt "non-EDP" end users could obtain meaningful results from such systems.

- An opportunity clearly exists, both within and outside of the in-house EDP establishment, for mini-based DBMS systems. This will be exploited by software, services, and hardware vendors, alone and in combination. A key element is to make the DBMS capability available to more users, particularly non-technical, "non-EDP" users.

2. OFF-LOADING THE HOST COMPUTER THROUGH USE OF MINIS

- There is a great deal of interest among vendors in off-loading some DBMS functions to a minicomputer or other specialized processor. To determine receptivity, users were asked to determine whether the following statements were high, low or about right:

- Conventional data entry without verification results in a 20% error rate on transactions.

  . Fifty-seven percent of users felt a 20% transaction error rate on conventional data entry systems was too high and projected a more likely figure to be 5-10%. This may be because many of the interviewees had responsibility for the data entry function and would exert extra care.
  . One interviewee was less optimistic, having done a detailed analysis of the operation of insurance agencies. It was found that transaction error rates were in excess of 35%.
  . In conclusion, error rates were recognized as a problem. Most users interviewed felt the capture of data at the source would contribute to a more economical system.

- Intelligent terminals used for editing and correction at the point of transaction can off-load central mainframes by 30%.

  . The possibility of off-loading a host mainframe by 30% through editing and correction of entries at the point of transaction was deemed more likely. Forty-five percent said the estimate was too high; 43% said it was about right; and 12% said it was too low.

- If minicomputers are used for not only data entry, but also for simple DBMS functions such as report preparation and inquiry at the local level, central mainframes could be off-loaded by 70%.

  . The estimate that hosts could be off-loaded by 70% through the use of DBMS on minicomputers was rejected by users: 81% felt the figure was too high; 16% said it was about right; and 3% stated it was low. However, half the users estimated 40-50% off-loading was possible.

- In conclusion, an opportunity exists for some off-loading of the host computers by minicomputer systems, but vendor estimates of off-loading above 40% will be met with user skepticism.

- With regard to users' awareness of data base computers, the concept is too new to elicit any defined pattern of user perception:

  - One set of users were sure IBM had one on the drawing boards.

  - Another was sure that IBM would not build one.

  - Although some users didn't know what it was they thought they could use one.

  - A majority of the respondents thought there would be one in the future, but had no idea when.

- The potential success of data base computers is unclear at this time. What is clear is that a great deal of user education will be required before the product has broad success.

3. EMERGENCE OF TEXT/GRAPHICS DATA BASES

- The integration of text processing with data processing has major ramifications for future data base systems design.

  - Eighty-four percent of 68 respondents felt this would occur.

  - Eighty-three percent felt DP management should be involved in the selection of word processing equipment.

  - Sixty-four percent felt the Data Base Administrator should be involved in the selection of such equipment.

- Graphics and data base systems are beginning to be combined. An example is General Motors' Relational General Information System (REGIS):

  - REGIS combines the features of relational information handling along with graphical, interactive, and statistical capabilities.

  - REGIS has been in use at GM for 2 years in a variety of applications. Project scheduling is a particularly successful application. A limitation of REGIS is that it cannot handle data bases over 5-10 million bytes.

  - General Motors reports: "Users love it."

- Inclusion of text and graphics capability must be a consideration in the design and development of DBMS if vendors hope to capitalize on this emerging user requirement.

C. PRODUCT STRATEGIES FOR DBMS

1. DESIRED ATTRIBUTES OF CURRENT DBMS OFFERINGS

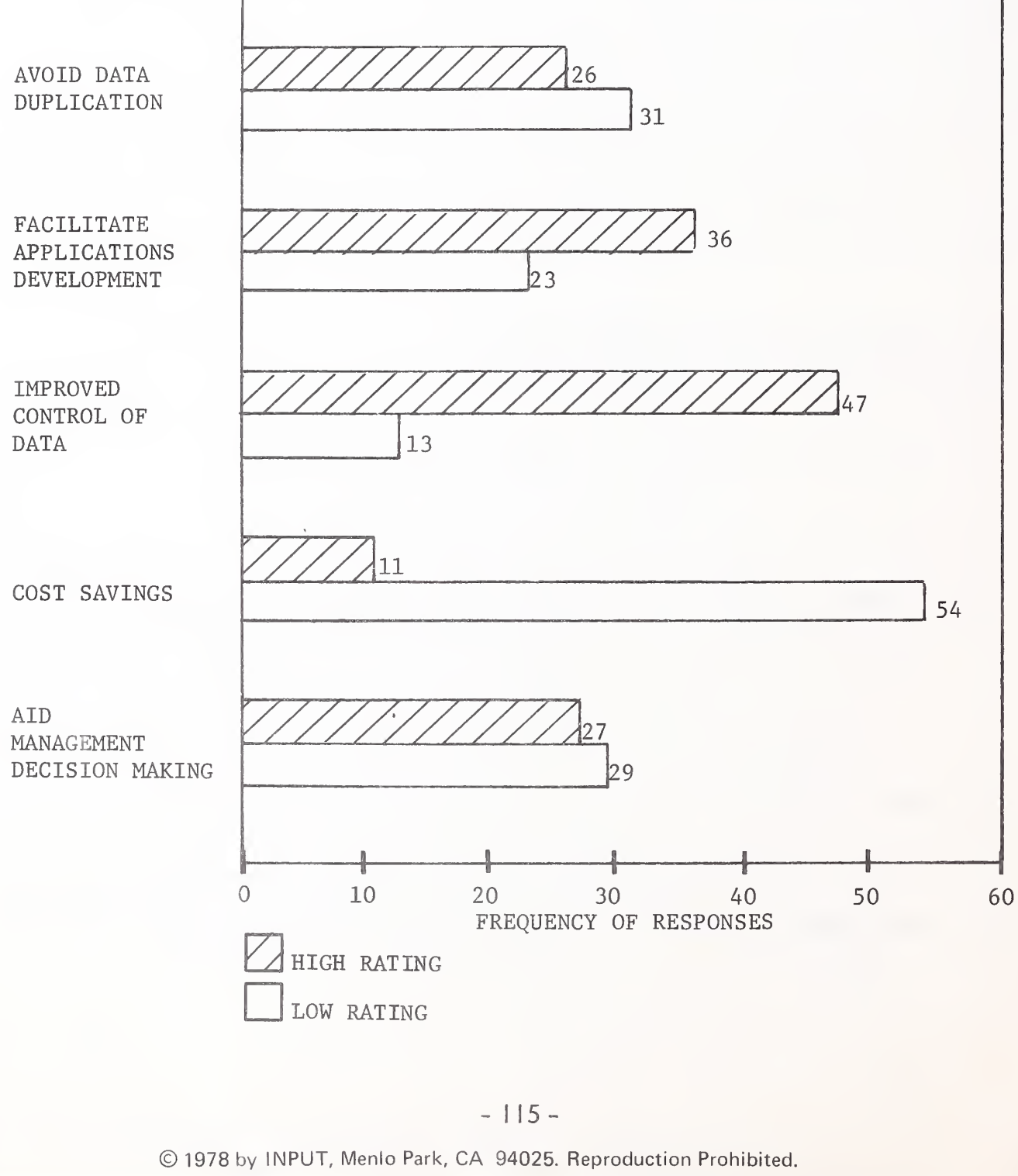
- Users were asked to rank five attributes of DBMS. The overall weighted ratings are contained in Exhibit VI-1. The most important attribute is improved control of data. Cost savings are rated surprisingly low, with users willing to pay a premium for faster applications development.

- The relatively high rating of "Facilitate Applications Development" reinforces the above point.

- Vendors can capitalize by emphasizing the capability of DBMS to assist the EDP manager in implementing applications in an environment of increasing complexity.

EXHIBIT VI-1

USER RANKING OF ATTRIBUTES OF CURRENT DBMS OFFERINGS (FREQUENCY OF HIGH AND LOW RATINGS)



2. DESIRED IMPROVEMENTS IN CURRENT DBMS OFFERINGS

- Users ranked ease of use and performance as the two most important features. (See Exhibit VI-2.) Vendor support and training were ranked quite low which indicates satisfaction with current levels of support.

  - A separate analysis of IMS users showed they placed performance as more important than ease of use which reversed the order established by the overall population. This is a reflection of the higher technical orientation of IMS users compared to users of most other DBMS products.

  - New users, as compared to the existing users interviewed in preparing Exhibit VI-2, would be expected to place a higher priority on training and documentation.

- The general facilities of DBMS systems requiring improvement most frequently requested were for improved communications interfaces and query languages.

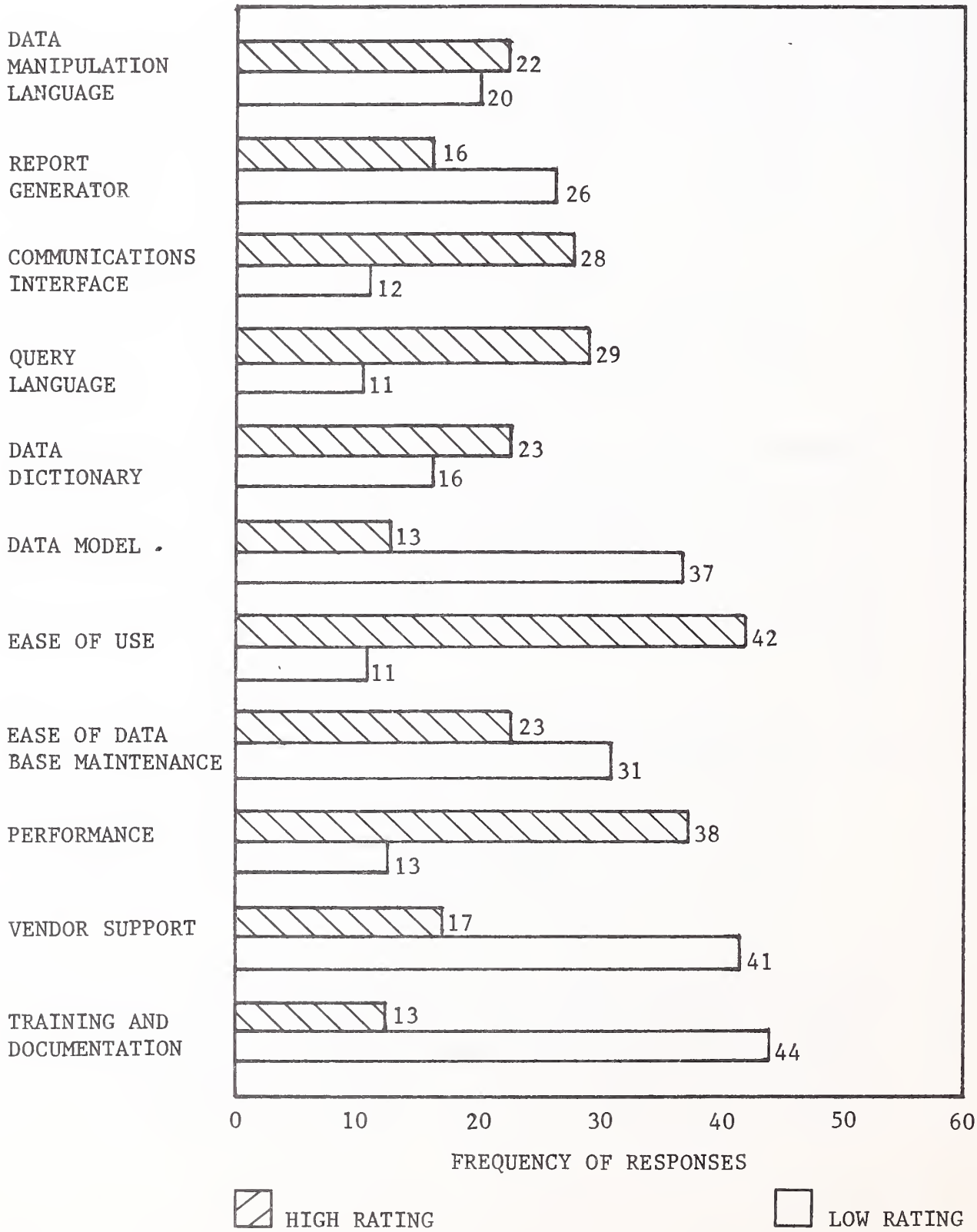
- The data model stands out clearly as the least important feature from the user's point of view, contrary to the high amount of publicity which has been given to this aspect.

  - Responses to the data model preference question were received from only one-third of the interviewees and were distributed evenly: 10 preferred hierarchical, 7 preferred network, and 8 preferred relational. The low response is largely due to a lack of user understanding of the differences among the alternatives.

- The product enhancements most desired by users can be summarized as follows: improved control of data, improved applications development capability, greater ease of use, higher performance (and a means of measuring performance), and improved query and communications capabilities.

EXHIBIT VI-2

USER RANKING OF DESIRED IMPROVEMENTS IN CURRENT DBMS OFFERINGS (FREQUENCY OF HIGH AND LOW RATINGS)



- Users were also asked about the adequacy of performance information and only 51% said they were satisfied. Those who wanted to see improvement stressed the unpredictability of the impact of applications on the overall system and the inability to determine how much resources the DBMS was using.

D. MARKETING STRATEGIES FOR DBMS

1. COMPETING WITH IBM

- Since IMS revenues represent 41% of the total DBMS market (see preceding section for details), competing with IMS represents an obvious potential opportunity. Extensive interviewing was carried out with IMS users to determine their level of satisfaction.

- Users gave a uniformly negative response as to their satisfaction with IMS. The reaction of users responding to this question is divided into four categories with representative comments.

  - In general, IBM as a vendor was held in much higher regard than their product, IMS.

- Nineteen respondents felt definite improvements must be made to IMS:

  - "Have to enhance it to be more responsive to queries in the teleprocessing environment."

  - "They have to improve it. It is not as flexible or as fast as other products."

  - "Have to reduce overhead costs."

  - "If IBM doesn't do something, users won't use it."

- "Have to modify or add things to make it conform to CODASYL DBTG recommendations."

- "Couldn't improve it enough!"

- Ten respondents transferred their faith in IBM to a faith in IMS:

  - "IBM will keep working on it until they get it right."

  - "IBM has taken many problem products to the market and made them successful."

  - "IBM will keep it. IMS sells a lot of hardware. They will continue to add more bells and whistles."

  - "IMS will continue to increase in use because it is an IBM product."

  - "IBM will keep and support IMS. They will also announce a new relational system."

- Nineteen felt IBM will replace IMS:

  - "A monster - it will have to be replaced."

  - "It will definitely be replaced."

  - "IMS can't be patched anymore, it is very inefficient."

  - "IBM should throw it out and start over. They should try to move some IMS functions to microcode."

  - "A real monster! Too hard to support. Takes a great number of personnel and hardware."

- "I hope they throw it away. It is terrible technically. IMS is a real bug-a-boo!"

- "If I were the IMS Product Manager in Yorktown or San Jose, I'd be working on a new DBMS!"

- Nine suggested ways to improve IMS:

  - Integration of IMS and CICS would be most advantageous."

  - "IBM will design a CPU to support it. They may develop a back-end data base computer or incorporate it with O/S."

  - "IBM will split IMS functions into multiple software packages. It is two to three years away."

  - "CICS is a strong alternative to DC of IMS. IBM will merge the two together to some degree. IMS is a compound product and does a lot - a lot you don't need."

  - "Use a multiple coupling feature. Place 3790 code in firmware."

  - "Marry it to CICS."

- One suspicious user felt IBM was working on something, but whatever they come up with will be nothing more than "a marketing ploy."

- Clearly, many IMS users are dissatisfied. The success DBMS vendors have had in competing with IMS as described in the "Competitive Environment" section of this report can be extended by building into DBMS products the attributes users desire, and which are not currently offered by IMS.

- The increasing willingness of users to use more than one DBMS furthers the opportunity to market to current IMS users.

2. EDUCATING DP MANAGERS

- More complex DBMS systems which combine the characteristics described in the previous sections presume a certain capability on the part of the DP manager. Exhibit VI-3 plots the understanding the respondents felt other data processing managers in their company would have of some commonly used terms:

  - As usual, the relational data model does not fare too well.

  - Value added networks are even less well understood.

  - Word processing scores surprisingly high. This indicates less resistance will be encountered in incorporating text processing in new applications.

  - The overall pattern demonstrates that DP managers do not have much confidence in their colleagues.

- In installing new DBMS applications, particularly if multiple sites are involved, the problem of educating managers must be addressed. A viable DBMS marketing strategy must deal with the issue of education.

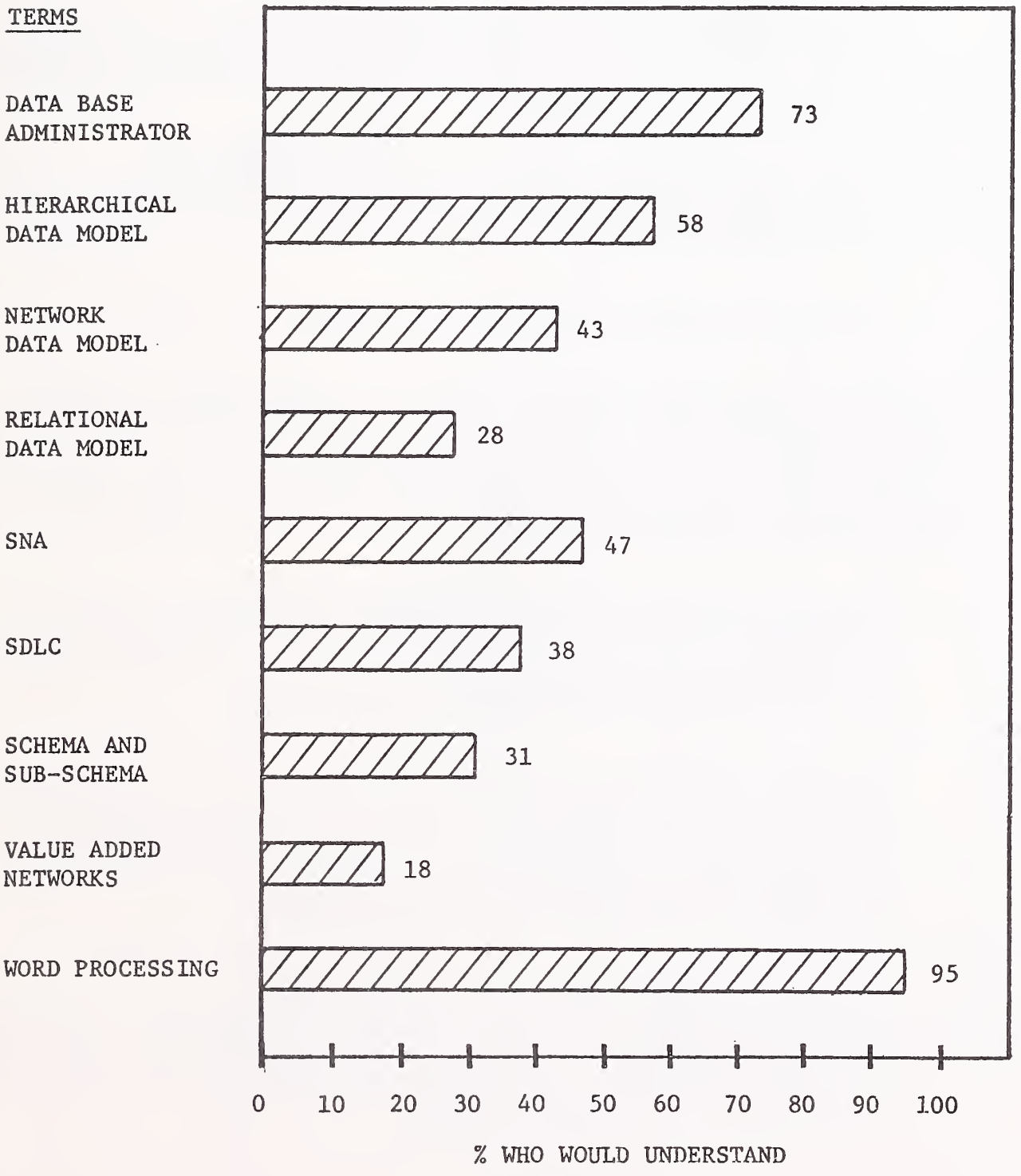
3. MARKETING IN A DISTRIBUTED DATA PROCESSING (DDP) ENVIRONMENT

- The question of what impact DDP would have on a DBMS elicited mixed responses. There appears to be no consensus among users as to what DDP really is.

- Many respondents commented it was "the wave of the future" or "the way the industry was going," but could not explain why.

EXHIBIT VI-3

RESPONDENTS' PERCEPTION OF OTHER DP MANAGERS' KNOWLEDGE



- Some generalizations on their comments:

  - IBM will go into DDP but it won't be with the 3790 communications system. Even though they are pushing SDLC and the 3790 concept, it is not being accepted well, according to users interviewed.

  - Minicomputer software is the inhibiting growth factor in the hardware area. Once minicomputer software becomes more reliable, the industry will see more DDP networks.

  - DDP is only valid for some applications. It will never totally replace centralized processing.

  - DDP won't be effective for three to five years.

- Even with the mixed user responses, DBMS is increasingly being considered in a distributed environment. To determine the extent to which DBMS and DDP are linked, users were asked to rate a range of applications using DBMS and DDP. Exhibit VI-4 displays the results:

  - For most applications, there was a significant percentage that believed a DBMS was essential for development. Exceptions were for data entry, text processing, and image storage and transmission.

  - For most applications using DDP there was not the same level of agreement. This is probably the result of lack of information/experience with DDP. There is obviously a level of experience with DBMS in the industry that has yet to be established for DDP.

  - The lack of familiarity with DDP is further supported by the number of users who responded to these questions. Sixty-eight out of 75 companies interviewed would respond to the DBMS questions while only 58 would respond to questions on DDP.

EXHIBIT VI-4

USER RESPONSES REGARDING IMPLEMENTING APPLICATIONS USING DBMS AND DDP

APPLICATION TO USE DBMS AND/OR DDP	USER RESPONSES					
	DBMS		DDP		NUMBER OF RESPONSES	
	YES (%)	NO (%)	YES (%)	NO (%)	DBMS	DDP
PAYROLL	82%	18%	57%	43%	72	63
DATA ENTRY	58	42	95	5	71	64
GENERAL ACCOUNTING	89	11	58	42	70	62
PERSONNEL	99	1	62	38	70	63
BILL OF MATERIALS	98	2	91	9	66	54
MATERIALS REQUIREMENT PLANNING	94	6	72	28	63	53
TEXT PROCESSING	50	50	80	20	64	55
MANAGEMENT INFORMATION SYSTEMS	100	0	62	38	71	63
STRATEGIC PLANNING	79	21	46	54	66	57
CUSTOMER/SALES RECORDS	99	1	83	17	70	59
ACCOUNTS RECEIVABLE/PAYABLE	96	4	67	33	69	58
IMAGE STORAGE/TRANSMISSION	32	68	65	35	66	48

- A further measure of user attitudes toward DBMS and DDP was developed through a series of "True" or "False" questions. These results are presented in Exhibit VI-5:

  - A majority (76%) feel that DBMS products are cost-effective while only a little more than one half have the same attitude toward DDP.

  - A similar mix exists for DBMS (78%) versus DDP (48%) as the preferred implementation approach.

  - DBMS products are currently thought to be effective (78%) but over half felt it would be at least five years before DDP will have the same level of effectiveness.

  - Both DBMS and DDP are recognized to require central control.

  - User ambivalence toward both DBMS and DDP indicate a prime user concern for end products of the process, rather than a concern about the process (DBMS or DDP) by which end products are achieved.

  - User positive attitudes (79%) toward DBMS software quality and negative attitude (26%) toward DDP software quality reflect the relative maturity and acceptance of these two products in the marketplace.

  - There was general consensus that most people don't understand either DBMS (90%) or DDP (88%).

- Clearly, DBMS has greater immediate user appeal with both DBMS and DDP requiring user education. DBMS strategy must consider now the impact of DDP in 1980 and beyond with the caution that DDP today is not yet a major driving force.

EXHIBIT VI-5

USER RESPONSES TO STATEMENTS CONCERNING DBMS AND DDP

USER RESPONSES / QUESTION	DBMS		DDP		NUMBER OF RESPONSES	
	TRUE %	FALSE %	TRUE %	FALSE %	DBMS	DDP
COST EFFECTIVE	76 %	24 %	58 %	42 %	71	72
THE WAY TO GO	78	22	48	52	69	60
WON'T BE EFFECTIVE FOR 5 YEARS	22	78	47	53	73	64
NEEDS CENTRAL CONTROL	92	8	90	10	74	67
USERS WANT IT	47	53	69	31	70	65
SOFTWARE POOR	21	79	74	26	71	62
JUST A FAD	1	99	11	89	73	66
MANAGEMENT LIKES IT	85	15	39	61	71	62
HELPS APPLICATIONS DEVELOPMENT	96	4	38	62	72	66
MOST PEOPLE WONT UNDERSTAND	90	10	88	12	73	68

4. INDUSTRIES BEST SUITED FOR DBMS AND DDP

- Users in selected industry sectors were asked the question of industries best suited for DBMS and DDP:

  - Results are on Exhibit VI-6.

  - All industries received positive ratings with banking and insurance scoring highest.

- These results reinforce the strong growth forecasts presented in earlier sections. DBMS will grow across all industry sectors.

5. MARKETING TO AN EXPANDING USER BASE

- A key point which is clear from the preceding analyses is that DBMS will be exposed to an expanding group of users, many of them non-technical. This will impact the marketing techniques of vendors wanting to capitalize on this development.

- The Remote Computing Services industry can be viewed as a leading indicator of how to approach this broader DBMS market in the future.

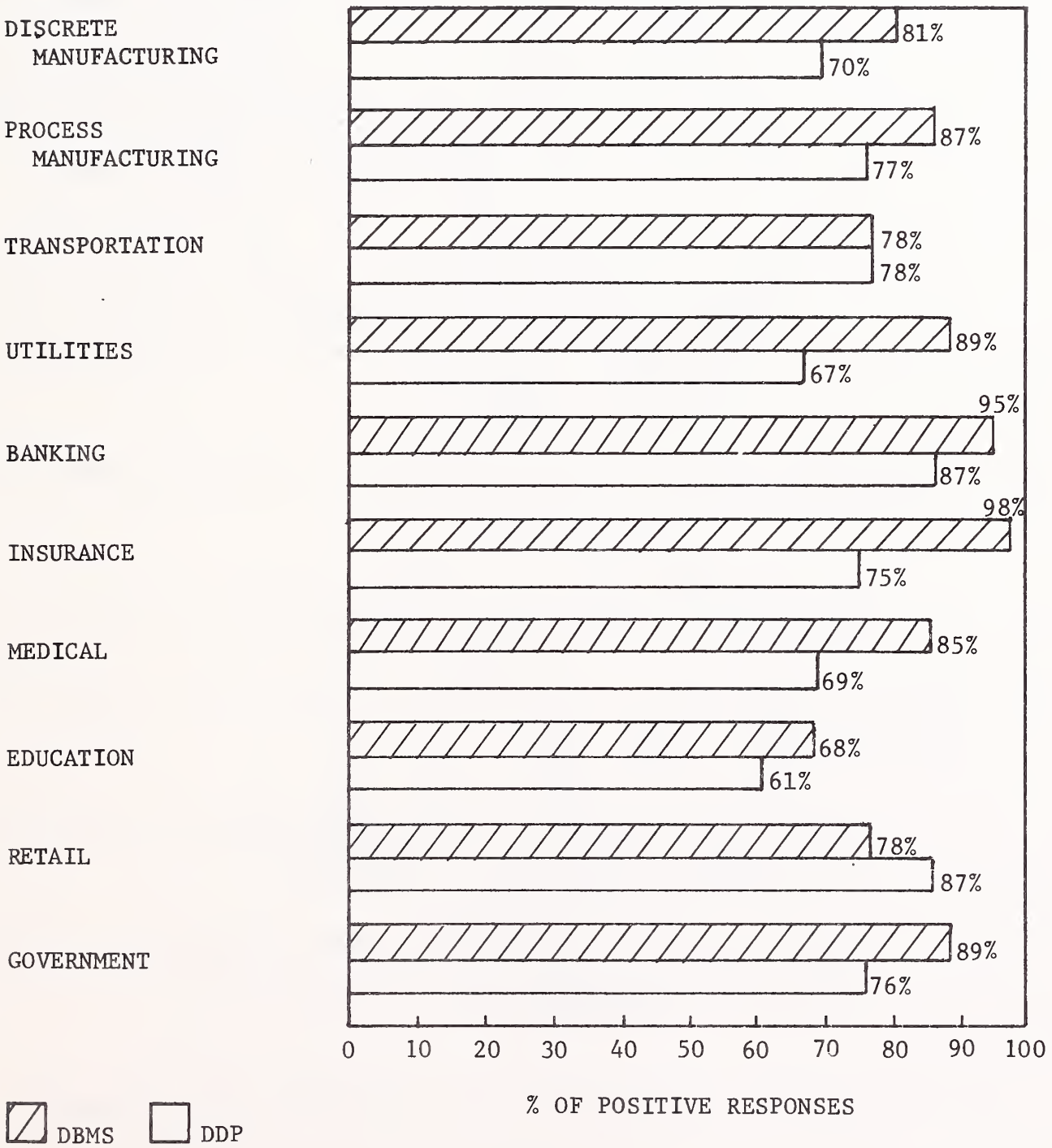
- RCS vendor revenues for services based on DBMS currently total $390 million per year, approximately four times current DBMS revenues from software sales. (INPUT's 1977 report, "Remote Computing Services Markets Based on Data Base Management Systems," covered the services market in detail.)

  - Over half of the services growth is on sales to non-technical users.

  - RCS vendors used one or more of the following five basic marketing strategies to reach users and develop growth with the trend being toward the latter strategies:

EXHIBIT VI-6

USERS' DESIGNATION OF INDUSTRIES BEST SUITED FOR DBMS AND DDP



1. Selling "Self-Help" - providing the service, but relying on the user to develop the applications. It is often used in IMS-based services and is the oldest technique.

2. Selling as a "Language" - presenting the DBMS service as a language compared to COBOL, FORTRAN, or assembly language.

3. Selling as a "Tool" - emphasizing how well the user can do inquiries and analysis after the system has been built rather than how effectively program development can be accomplished.

4. Selling "Custom Programming" - vendors use DBMS services to develop specific user applications faster and/or less expensively than competitors using conventional programming languages.

5. Selling "Pre-Packaged Applications" - vendors use the DBMS to develop generalized application programs which are then implemented for individual customers with some degree of modification.

- The projected success of the above strategies for services was developed in the 1977 study and is shown on Exhibit VI-7.

  - The higher growth potential is in the more differentiated products.

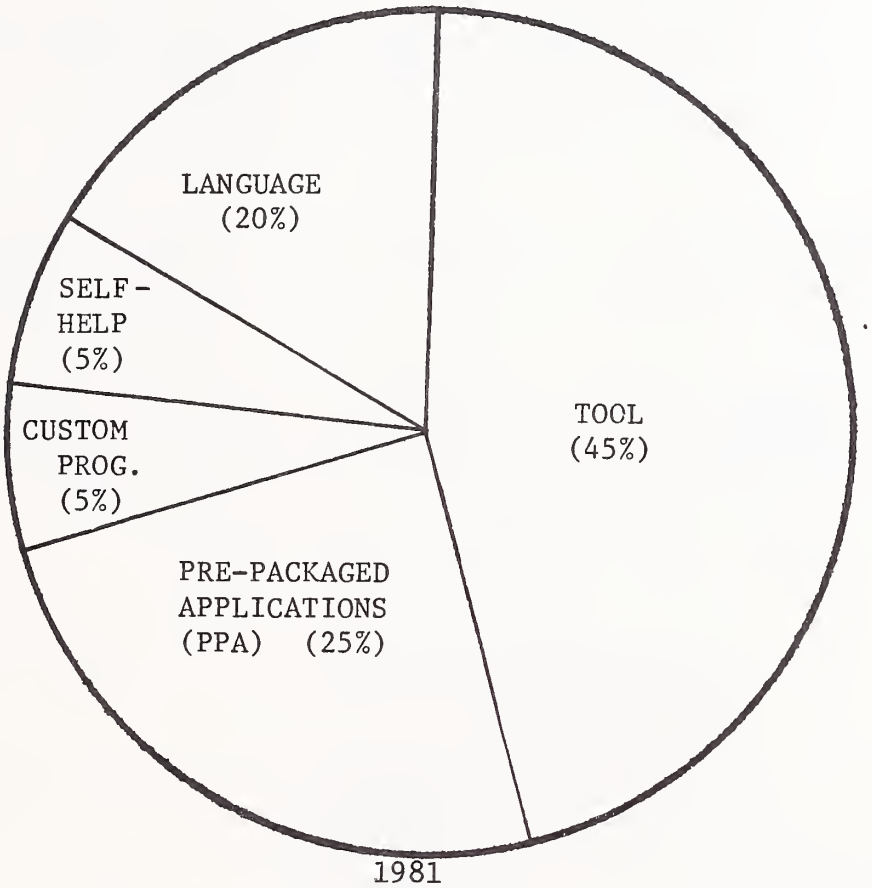
- Some similar strategies are now apparent among software vendors and hardware vendors:

  - Insyte has set up a separate unit to do custom programming, and market pre-packaged applications based on their DBMS.

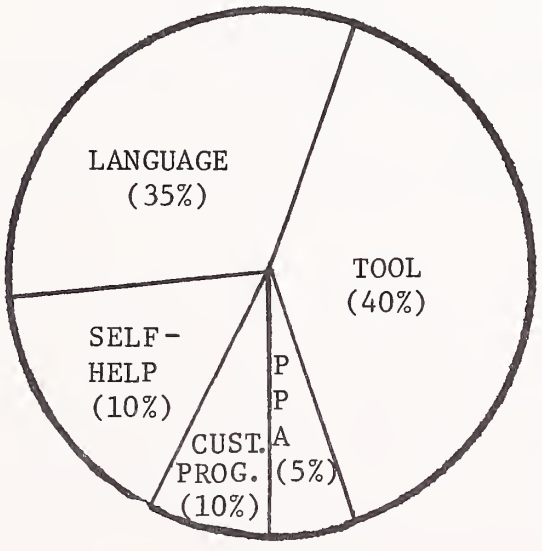
  - Hewlett-Packard, a minicomputer and DBMS vendor, talks in terms of marketing an "applications engine."

EXHIBIT VI-7

DATA BASE MANAGEMENT SYSTEMS SERVICES MARKET SHARE BY PRODUCT STRATEGY: 1976-1981



1981
$970 MILLION



1976
$241 MILLION

REFERENCE: INPUT 1977 REPORT "DATA BASE MANAGEMENT SYSTEMS SERVICES"

- Almost all vendors of DBMS software are showing increased interest in applications development.

- The more differentiated products require a shift from "features" selling to "solutions" selling as presented in Exhibit VI-8.

- DBMS software vendors currently emphasize "features" selling. To follow the lead of the RCS vendors, they must shift to more "solutions" selling.

  - Since, as reported earlier, almost 75% of DBMS software selections are made with a specific application in mind, the potential does exist to move software selling to an application/solution mode from the prevalent technical/ feature mode. This will:

    . Require marketing personnel with a greater knowledge of user applications.
    . Require more easily understood packages and documentation.
    . Increase industry-oriented marketing.

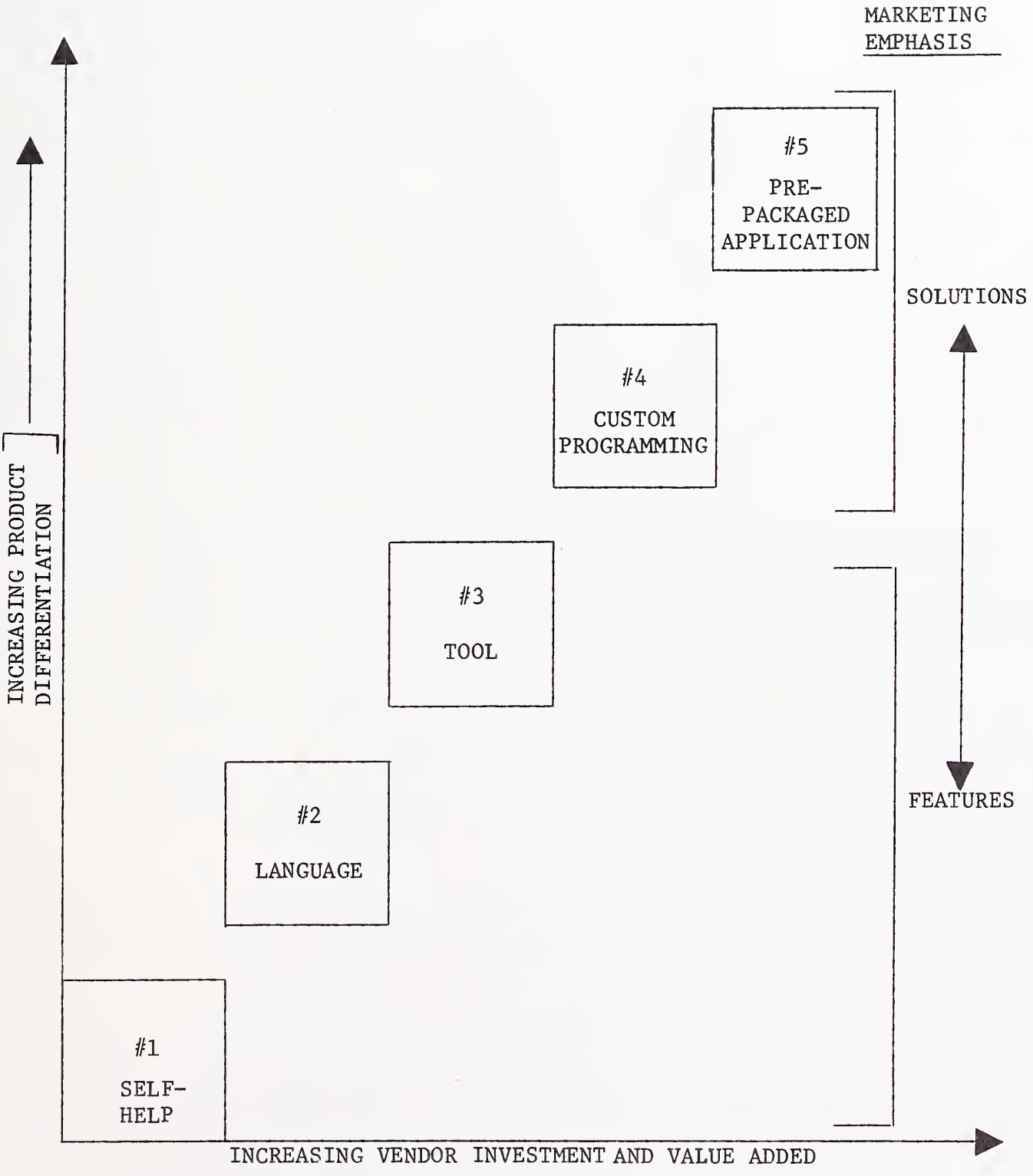
- As the DBMS software market grows toward non-technical users, vendors who respond to this change through more speciaized products and marketing will:

  - Participate in the growth of mini-DBMS products.

  - Realize a higher value added on sales to current DBMS markets.

EXHIBIT VI-8

DATA BASE MANAGEMENT SYSTEMS SERVICES PRODUCT STRATEGY IMPLICATIONS



APPENDIX A: INTERVIEW PROFILE FOR THE DATA BASE MANAGEMENT SOFTWARE MARKETS

APPENDIX A: INTERVIEW PROFILE FOR THE DATA BASE MANAGEMENT SOFTWARE MARKETS

	On-Site	Telephone	Mail Questionnaires	Total
DBMS VENDORS	6	11		17
RCS VENDORS		3		3
THIRD PARTY				
KNOWLEDGEABLES		5		5
USERS				
DISCRETE MANUFACTURING		5	36	41
PROCESS MANUFACTURING		5	30	35
TRANSPORTATION	1	4	6	11
UTILITIES	1	4	11	16
BANKING & FINANCE	4	9	16	29
INSURANCE		5	30	35
MEDICAL		5		5
EDUCATION		5	25	30
RETAIL		3	8	11
WHOLESALE		2	8	10
STATE & LOCAL GOV'T.	2	3		5
SERVICES	1	9	8	18
OTHER	2	5	5	12
	17	83	183	258

APPENDIX B: DEFINITIONS

APPENDIX B: DEFINITIONS

- **COMPUTER SERVICES**

  These are services provided by vendors which perform data processing functions using vendor computers, or assist users to perform such functions on their own computers.

- **REMOTE COMPUTING SERVICES (RCS)**

  Provision of data processing to a user by means of terminals at the user's site/s connected by a data communications network to the vendor's central computer. The three sub-modes of RCS are:

  1. INTERACTIVE (timesharing) is characterized by interaction of the user with the system, primarily for problem solving timesharing, but also for data entry and transaction processing; the user is "on-line" to the program/files.

  2. REMOTE BATCH is where the user hands over control of a job to the vendor's computer which schedules job execution according to priorities and resource requirements.

  3. DATA BASE is characterized by the retrieval of information from a vendor-maintained data base. This may be owned by the vendor or a third party.

- **BATCH SERVICES**

This includes data processing performed at vendors' sites of user programs and/or data which are physically transported (as opposed to electronically by telecommunications media) to and/or from those sites. Data entry and data output services, such as keypunching and COM processing, are also included. Batch services include those expenditures by users which take their data to a vendor site which has a terminal connected to a remote computer used for the actual processing.

- **SOFTWARE PRODUCTS**

This category is for users' purchases of systems and applications packages for use on in-house computer systems. The figures quoted include lease and purchase expenditures, as well as fees for work performed by the vendor to implement and maintain the package at the users' sites. Fees for work performed by organizations other than the package vendor are counted in professional services. The two sub-categories are:

1. SYSTEMS PACKAGES are operating systems, utilities, and language routines that enable the computer/communications system to perform basic functions. This software is provided by the mainframe manufacturers with their hardware; other vendors provide improved versions of this and special-purpose routines. This classification includes compilers, data base management software, communications packages, simulators, performance measurement software, diagnostic software, and sorts.

2. APPLICATIONS PACKAGES are software which perform processing to serve user functions. They consist of general purpose packages, such as for accounting and inventory control, and special purpose packages, such as personal trust, airline scheduling, and demand deposit accounting.

- PROCESSING SERVICES

Processing services encompass FM, RCS, and batch services: they are categorized by type of service, as distinguished from mode of service, bought by users as follows:

- GENERAL BUSINESS services are processing services for applications which are common to users across industry categories. Software is provided by the vendor; this can be a complete package, such as a payroll package, or an application "tool," such as a budgeting model, where a user provides much of the customizing of the finished product it uses. General business processing is often repetitive and transaction oriented.

- SCIENTIFIC AND ENGINEERING services are the processing of scientific and engineering problems for users across industries. The problems usually involve the solution of mathematical equations. Processing is generally problem solving and is non-repetitive, except in the sense that the same packages or "tools" are used to address different, but similar, problems.

- INDUSTRY SPECIALTY services provide processing for particular functions or problems unique to an industry or industry group. The software is provided by the vendor either as a complete package or as an application "tool" which the user employs to produce its unique solution. Specialty applications can be either business or scientific in orientation; data base services where the vendor supplies the data base and controls access to it (although it may be owned by a third party) are also included under this category. Examples of industry specialty applications are: seismic data processing, numerically-controlled machine tool software development, and demand deposit accounting.

- UTILITY services are those where the vendor provides access to a computer and/or communications network with basic software that enables any user to develop its own problem solution or processing system. These basic tools include terminal handling software, sorts, language compilers, data base management systems, information retrieval software, scientific library routines, and other systems software.

- **DBMS TERMINOLOGY**

  - HIERARCHICAL STRUCTURE - a file in which some records are subordinate to others in a tree structure.

  - NETWORK - a relationship between records or other groupings in which a child record can have more than one parent record.

  - RELATION - consists of the following:

    . A flat file.
    . Two dimensional array of data elements.
    . A file in normalized form.

  - RELATIONAL DATA MODEL - a data base made up of relations. Its data base management system has the capability to recombine the data elements to form different relations, thus giving great flexibility in the usage of data.

  - SEQUENTIAL - where data records are arranged in a serial manner on the mass storage device.

  - INDEXED SEQUENTIAL - where data records are partitioned into smaller groups. Each group location is identified by an index and records in a particular group are sequentially arranged.

- INVERTED STRUCTURE - refers to the way keys (searchable data elements) are maintained. They are like indexed sequential except the index is the keyed data element.

Source: James Martin, Principles of Data Base Management, Prentice-Hall, 1976.

APPENDIX C: RELATED INPUT REPORTS

APPENDIX C: RELATED INPUT REPORTS

Title	Industry Report Number	Publication Date
REMOTE COMPUTING SERVICES MARKETS BASED ON DATA BASE MANAGEMENT SYSTEMS	7	AUG 1977
COMPUTER SERVICES INDUSTRY ANNUAL REPORT - 1977		NOV 1977
REALITIES OF DISTRIBUTED DATA PROCESSING		JUNE 1978
CURRENT TRENDS IN COMPUTER SERVICES AND SOFTWARE PACKAGE PRICING		JULY 1978

Contact: Michael P. Burwen, Vice President, Marketing, at (415) 854-3422.

APPENDIX D: SURVEY QUESTIONNAIRES

CATALOG. NO. M-SDB

DATA BASE MANAGEMENT SYSTEMS

USER QUESTIONNAIRE

1. Do you currently have a DBMS installed? YES ☐ NO ☐

   a) Name of DBMS: _____

   b) Date installed: _____

2. If you don't have a DBMS, why not?

   _____

   _____

   _____

   a) Would you use a DBMS on an RCS before bringing one in-house?
      YES ☐ NO ☐

   Go to Question #20, page 5.

3. What prompted you to by a DBMS?

   _____

   _____

   _____

4. What percent of your total applications do you use your DBMS? _____%

5. Did you perform an extensive analysis of DBMS packages on the market before selection?
   YES ☐ NO ☐

   a) If yes, which other ones were considered?

   _____

6. Why did you select your DBMS?

7. What triggered your decision to buy a DBMS? Was it due to a particular application?

8. How did you justify buying it?

9. What did you promise users as far as benefits?

   a) Were these benefits achieved? YES ☐ NO ☐

   Comments:

10. Did the EDP Manager have the authority to recommend and buy the DBMS?

    YES ☐ NO ☐

    a) If no, who made the decision?

11. Before selecting a DBMS did you use a DBMS service on a remote computing service? YES ☐ NO ☐

a) If yes, list vendor name and DBMS used.

_____

12. If you previously used a DBMS on a remote computing service, did you decide to bring it in-house because you were spending too much? YES ☐ NO ☐

a) If yes, how much was this?

_____

13. How much have you spent on your DBMS?

a) Cost for initial system or monthly lease $_____

b) Other features, routines or interface packages added later $_____

c) Training costs $_____

d) Conversion costs $_____

e) Other (specify) _____ $_____

Total Investment $_____

f) Current annual expenditure $_____

g) Average annual cost for training $_____

14. What is the level of programmer experience required to support the DBMS?

_____

_____

15. Do you see your expenditures for DBMS increasing or decreasing by 1980 and by what percent?

☐ increase _____%

☐ decrease _____%

16. Have you upgraded your computer since your DBMS was installed?

YES ☐ NO ☐

a) If yes, was this directly related to the DBMS? YES ☐ NO ☐

Comments: _____

_____

_____

17. What applications have you developed using your DBMS?

a) _____

b) _____

c) _____

d) _____

e) _____

18. What is the most difficult aspect of implementing DBMS applications?

_____

_____

_____

19. If you had to do it over again, would you still buy a DBMS?

YES ☐ NO ☐

a) If no, why? _____

_____

b) If yes, would it be the same one you are using?

YES ☐ NO ☐

1. If no, which one would you select?

_____

20. What are the most important attributes of DBMS systems? (Forced Ranking)

	Rank 1 through 5
Avoid data duplication	_____
Facilitate applications development	_____
Obtain improved control of data which is a valuable resource	_____
Cost savings	_____
Support management decision making	_____
Other_____	_____

21. Considering current DBMS systems, what are the most important improvements which would facilitate increased use? (Forced Ranking)

	Rank 1 through 5
Vendor support	_____
Ease of use (programming applications development)	_____
Ease (and flexibility) of DB maintenance	_____
Performance	_____
Training and documentation	_____
Other _____	_____

22. If you have a DBMS, are you satisfied with the information you are receiving on performance measurement?

Yes ☐ No ☐

23. a) If no, why not? _____

_____

_____

b) If yes, what information do you receive that is the most helpful?

_____

_____

_____

24. What are the most important DBMS systems features requiring improvement (or implementation)? (Forced Ranking)

	Rank 1 through 6
Data manipulation language	_____
Report generation	_____
Communications interface	_____
Query language	_____
Data dictionary	_____
Data models (Hierarchical, Network, Relational - circle if they have a preference)	_____
Other: _____	_____

25. Data entry is important whether or not you use a DBMS. What is your reaction to the following statements?

a) Conventional data entry (K-P, K-T, K-D) without verification results in 20% error rates on transactions. Is this

High ☐ Low ☐ About right ☐

b) Intelligent terminals used for editing and correction at the point of transaction can offload central mainframes by 30%. Is this

High ☐ Low ☐ About right ☐

c) If minicomputers are used for not only data entry but simple DBMS functions such as report preparation and inquiry at the local level, central mainframes could be off-loaded by 70%.

High ☐ Low ☐ About right ☐

26. If you have minicomputers or intelligent terminals installed, how are they being used? (Primary Functions)

	No. of Systems
a) Scientific Timesharing	_____
b) Batch Scientific	_____
c) Process Control	_____
d) Data Entry	_____
e) Batch Commercial	_____
f) Interactive Commercial	_____
g) Cluster Controller	_____
h) Text Processing/Word Processing	_____

27. Are any of your systems (listed above) making significant use of DBM software? (Circle those which are.)

28. Would the availability of DBMS on minicomputers make mini's more attractive to you?

Yes ☐ No ☐

To end users? Yes ☐ No ☐

29. Can or could "non-EDP" users get meaningful results from "mini-data base" systems without assistance from programmers (other than vendor SE support)?

Yes ☐ No ☐

30. What do you think will happen with:

a) IMS? _____

_____

_____

b) Distributed Processing? _____

_____

_____

c) DBMS on minicomputers? _____

_____

_____

d) Data base computer? _____

_____

_____

e) Is there a trend towards relational structures? _____

_____

_____

31. Are the following statements about DBMS and DDP true or false? (Record T or F)

	DBMS	DDP
Cost effective	____	____
Definitely the way to go	____	____
Won't be effective for 5 years	____	____
Need central control	____	____
Users want it	____	____
Software poor (or not available)	____	____
Just a fad	____	____
EDP management likes it	____	____
Helps applications development	____	____
Most people don't understand	____	____

31. Would most other Data Processing Managers in your company understand the following terms and be able to give a brief explanation of them?

	Yes	No
Data base administrator	☐	☐
Hierarchical data structure	☐	☐
Network data structure	☐	☐
Relational data structure	☐	☐
SNA (System Network Architecture)	☐	☐
SDLC (Synchronous Data Link Control)	☐	☐
Schema/Subschema	☐	☐
Modem	☐	☐
Value Added Network	☐	☐
Word Processing	☐	☐

a) Is it important for them to have an understanding of such terms?

Yes ☐ No ☐

32. There is talk that word processing and data processing are converging (Datamation, April 1977). Do you think this will happen?

Yes ☐ No ☐

a) Should DP be involved in selection and installation of Word Processing Systems?

Yes ☐ No ☐

b) Should the Data Base Administrator be involved?

Yes ☐ No ☐

33. Do the following applications areas lend themselves to DBMS and/or DDP? (Record Yes/No)

	DBMS	DDP
Payroll	_____	_____
Data Entry	_____	_____
General Accounting	_____	_____
Personnel Records	_____	_____
Bill of Materials	_____	_____
Materials Requirements Planning	_____	_____
Text Processing	_____	_____
Management Information Systems	_____	_____
Strategic Planning Systems	_____	_____
Customer & Sales Records	_____	_____
Accounts Payable/Receivable	_____	_____
Image Storage/Transmission	_____	_____

34. Are the following industry segments more or less appropriate than most for DBMS or DDP? (Record More or Less.)

	DBMS	DDP
Retail/Distribution	_____	_____
Education	_____	_____
Banking	_____	_____
Government	_____	_____
Hospitals & Health	_____	_____
Hotels & Motels	_____	_____
Insurance	_____	_____
Legal	_____	_____
Manufacturing, Discrete	_____	_____
Manufacturing, Process	_____	_____
Transportation	_____	_____
Public Utilities	_____	_____
Law Enforcement	_____	_____
Other Good or Bad	_____	_____

35. Other comments (trends/problems with DBMS or DDP): _____

_____

_____

_____

DATA BASE MANAGEMENT SYSTEMS

Vendor Questionnaire

1. Name(s) of the DBMS packages you offer, year introduced and number of installations.

DBMS Name	Year Introduced	Number of Installations	Type of Data Structure

2. How much did it cost you to develop your DBMS? $_____

3. How much would it cost to develop a new DBMS today? $_____

4. What were your 1977 revenues from your DBMS?

NAME OF DBMS	REVENUES

5. What percent increase in your DBMS revenues do you forecast for:

1978 _____ 1980 _____ 1983 _____

6. What is your share of the DBMS market? _____%

7. Which vendor has the largest share of the market?

Vendor Name _____ _____%

8. How do you price your DBMS?

- ☐ Outright purchase only
- ☐ Purchase or lease option
- ☐ Lease option only
- ☐ Bundled with hardware

9. What is the purchase or lease price of your DBMS?

PURCHASE	LEASE
_____	_____
_____	_____
_____	_____

10. What is the average sales/lease price of your DBMS?

Sales $_____ Lease $_____

11. What percent of your customers purchase or lease your DBMS?

Purchase ____% Lease _____%

12. What is the the minimum annual sales of a company in order for you to consider them a prospect? $_____

13. What is required of the customer to support your DBMS in terms of:

Hardware _____

Number of Personnel _____

Skill level of programmers _____

Other _____

14. What is the average on-going cost of a company to maintain your DBMS once its been installed? $_____

a) Do you think this is

☐ Less than if they used conventional methods

☐ More than if they used conventional methods

☐ A wash - they would incur the same costs

15. How do your customers pay for maintenance?

☐ Included in lease/purchase price

☐ Pay separately

$_____ average annual amount

16. What are the main problems you are facing in:

Marketing your DBMS _____

_____

_____

Supporting your DBMS _____

_____

_____

Other _____

_____

_____

17. What do you feel are the key elements of being a successful DBMS vendor?

_____

_____

_____

18. What do you consider is unique about your DBMS? _____

19. What are the main reasons your customers:

Buy your DBMS _____

Do not buy your DBMS _____

20. Do you concentrate your marketing efforts on any particular industry sector(s)? YES ☐ NO ☐

a) If yes which ones? _____

b) Are there any industry sectors which are not candidates for your product? YES ☐ NO ☐

If yes which ones? _____

c) Which industry sectors are the most difficult to sell and why?

21. Who are your major competitors and what are the strengths and weaknesses of their products versus yours?

NAME	STRENGTHS	WEAKNESSES
_____	_____	_____
_____	_____	_____
_____	_____	_____
_____	_____	_____

22. Do you have any new product plans for DBMS? (Major revisions, enhancements or a new DBMS) YES ☐ NO ☐

Comments: _____

_____

_____

_____

23. At what point in time do users of a DBMS service on a network bring the DBMS in-house? What triggers their decision?

_____

_____

_____

a) What percent of your customers were previous users of a DBMS on a network? ____%

24. How, in your opinion, do customers rank the following criteria when choosing a DBMS? (Rank in order of importance, 1 through 6)

____ DBMS features

____ Vendor service reliability

____ Vendor technical support

____ Vendor price

____ Vendor experience with their application

____ DBMS availability elsewhere

25. Do you foresee the following changes happening with DBMS? If yes, when do you think this will happen and what is the likelihood of occurrence? (Rate H = High, M = Moderate, L = Low)

	Year	Rating
a) Putting DBMS code in firmware YES ☐ NO ☐	_____	_____
b) Integration of DBMS with operating systems YES ☐ NO ☐	_____	_____
c) Back end data base computer YES ☐ NO ☐	_____	_____
d) Putting more complex DBMS on minicomputers YES ☐ NO ☐	_____	_____

26. What impact will the following technological changes have on DBMS?

a) Distributed processing _____

_____

_____

b) Value Added Networks _____

_____

_____

c) Satellite communications _____

_____

_____

d) Mass Storage _____

_____

_____

e) Main memory (IBM's strategy) _____

_____

_____

f) DBMS on mini's _____

_____

_____

g) Distributing data bases _____

_____

_____

27. Are there any other developments or trends which will have a significant impact on the DBMS market during the next 3 years?

YES ☐ NO ☐

a) If yes, specify _____

_____

_____

_____

28. Are the following statements TRUE or FALSE? (Record T or F)

	TRUE	FALSE
DBMS software is one of the most stable software systems around.	____	____
A Data Dictionary/Directory is an integral part of a DBMS.	____	____
DBMS's developed 3 years from now will have relational data structures.	____	____
The availability of a DBMS and a COBOL compiler on a minicomputer will be very attractive to many companies.	____	____
Data base computers are secretly being developed by hardware manufacturers and will be available in 3 years	____	____

	TRUE	FALSE
The host CPU in a distributed environment is primarily a data base.	____	____
The more you distribute, the more your processing becomes simply a terminal and a data base.	____	____
The trend towards IMS is still strong.	____	____
IBM will combine DL/1, CICS and IMS and merge into a single DBMS	____	____
There will be a merging of text/graphics processing with DBMS in 3 years	____	____

29. There has been a great deal of discussion on the advantages and disadvantages of data models (hierarchical, network and relational), do you think there will ever be an industry standard on data models?

YES ☐ NO ☐

Comments _____

_____

_____

_____

30. Do you see any trends in the industry towards one model? YES ☐ NO ☐

Comments _____

_____

_____

_____

31. Has your company established a position on the type of model to use?

YES ☐ NO ☐

Comments _____

_____

_____

32. Other comments on the advantages or disadvantages of data models.

33. There is talk that word processing and data processing are converging. Do you think this will happen? YES ☐ NO ☐

If yes, when? _____year

34. Additional comments:

MAS SDB QUESTIONNAIRE ADDENDUM

1. How many packages did you sell in 1977? (DBMS)

   Number _____

2. What percent of your DBMS revenues were spent for marketing? _____%

3. How many technical support people do you have supporting your DBMS?

4. How many salesmen do you have? _____

5. What is the average number of packages sold per salesman? _____

6. Is your DBMS on any remote computing network? ☐ yes ☐ no

   If yes, which ones? _____ _____

   _____ _____

   _____ _____

   _____ _____

7. What percent of your DBMS revenues comes from royalty payments from the RCS vendors?

   _____%

8. What is different about DBMS now as opposed to the way they were 3-5 years ago?

   _____

   _____

   _____

   _____

   _____

9. What new features or changes will occur with DBMS in the future?

   _____

   _____

   _____

   _____

   _____